



BS

# SMALL TOOLS

· CATALOG ·

BS NO. 27 BS



## IMPORTANT

List Prices in this catalog have been revised in accordance with the enclosed blue pamphlet. Prices on all High Speed Steel Cutters and all High Speed Steel Screw Machine Tools are withdrawn temporarily.

BROWN & SHARPE MFG. CO.

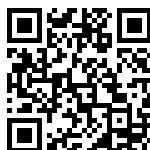
**BROWN & SHARPE MFG. CO.**  
**PROVIDENCE, R. I., U. S. A.**

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# SMALL TOOLS

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CATALOG No. 27

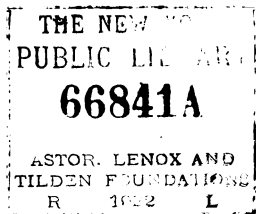
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**BROWN & SHARPE MFG. Co.**

**PROVIDENCE, R. I., U. S. A.**

**Established 1833.**

**ALSO MANUFACTURERS OF**  
**MILLING MACHINES, GRINDING MACHINES, SCREW MACHINES,**  
**GEAR CUTTING MACHINES.**

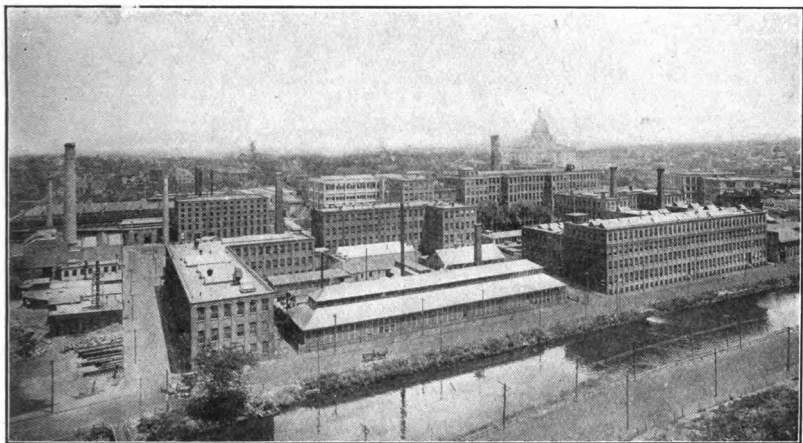


**COPYRIGHT**

**1916**

**BY BROWN & SHARPE MFG. CO.**

WATSON  
JUN  
1916



1916



1872

### **LEADING AWARDS RECEIVED**

London, 1862; Paris, 1867 and 1878; Vienna, 1873; Philadelphia, 1876; Chicago, 1893; Tennessee Centennial Exposition, 1897; Buffalo, 1901; Paris, Grand Prix, 1889 and 1900; Brussels, Grand Prix, 1897 and 1910; St. Louis, Grand Prize, 1904; Liège, Grand Prix, 1905; Milan, Grand Prix, 1906; Brussels, Grand Prix, 1910; Turin, Grand Prix, 1911.

## Of Interest.

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The business now conducted by the Brown & Sharpe Mfg. Co. was founded in 1833 by David Brown and his son Joseph R. Brown. David Brown retired in 1841 and the business was continued by Joseph R. Brown until 1853, when Lucian Sharpe became his partner and the firm of J. R. Brown & Sharpe was formed. The Brown & Sharpe Mfg. Co. was incorporated in 1868.

The manufacture of Steel Rules and other tools of precision was begun by Joseph R. Brown in 1850 and in 1852 Samuel Darling began a similar line of work.

The partnership of Darling, Brown & Sharpe was formed in 1866 and the business carried on under that name until the partnership was dissolved by the purchase of Mr. Darling's interest.

**The Buildings** are modern and especially arranged to meet the requirements of the business. The machine shops are fire-proof. The business, therefore, is free from danger of serious interruption and, on work entrusted to us, customers are given security against loss by fire.

**Floor Area.** The seven main manufacturing buildings have a floor space of about 650,000 sq. ft., and the foundry about 240,000 sq. ft., the forging, hardening, central power plant and miscellaneous buildings about 200,300 sq. ft. In 1853 the floor space occupied was 1,800 sq. ft.; the present buildings have 1,090,000 sq. ft. of floor space, or about 25 acres.

**Our Tools and Appliances** are the best attainable. The tools described in this catalogue are made with the intention that they shall be the best in their respective classes. Careful attention is constantly given to insure workmanship of the best quality.

**Prices and Dimensions.** The prices and dimensions are subject to change without notice.

**Orders.** We would request our customers to use the names or numbers of tools as printed in the catalogue. This will enable us to fill orders promptly and correctly. We are often at a loss to know what is wanted when different names or descriptions are employed.

We would impress upon purchasers the advantages of ordering, if possible, articles that are made in large quantities and carried in stock, in the place of goods that vary only slightly from them, but have to be made to order.

Parties ordering small quantities of goods from us direct will please enclose either a Check on New York, a Post Office Money Order or currency for the amount of goods wanted, which will be forwarded at once by express or as may be directed.

When goods are ordered to be sent by express, with bill to be collected on delivery, the express charge for collecting will be added. Small articles can be sent by mail when additional cost of postage is remitted. We are not responsible for losses in the mails.

In ordering special tools to be graduated and figured, our customers are particularly requested to send a clear description and a sketch showing the exact position of figures and graduations wanted.

All verbal orders and instructions should be confirmed in writing. Please address all business communications to the Company.

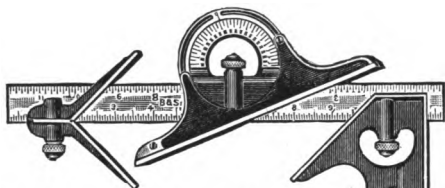
The Tools described in this catalogue are carried in stock. They are sold by instrument and hardware dealers throughout the country and may usually be obtained at once, thus saving delay and the cost of transportation.

In cases where these cannot be readily procured from dealers, we will send any of our Machinists Tools on receipt of price to any place in the United States or Canada.

Should any defect become apparent in the workmanship of any of our tools, we request that we be promptly notified of the same.

We are always ready and pleased to show our works to those who are interested in machine shop practice.

## Electrotypes.



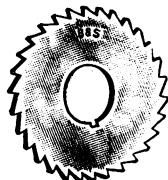
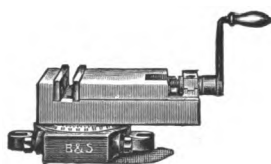
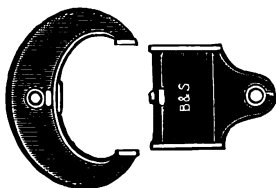
We are always glad to provide electrotypes of our goods to any dealers requesting them, for use in making up catalogues, folders and newspaper advertisements or for other purposes.

By using cuts of our goods in their advertising, dealers receive the benefit of our extensive advertising in technical papers by connecting it with their store.

We carry a stock of electrotypes of all the tools, cutters and equipment shown in this catalogue, and are ready to furnish them free of charge. These cuts are of the sizes shown in this catalogue or our General Catalogue of Machinery and Tools.

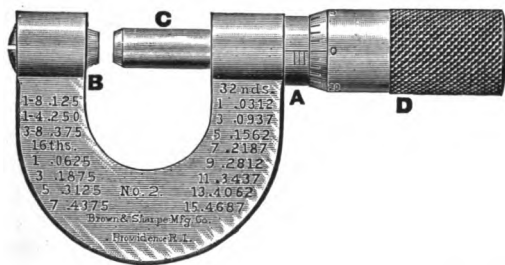
**For Dealers' Catalogues and Newspapers.** We also have a complete line of cuts of all tools, cutters, etc., shown in this catalogue, of a small size suitable for dealers' catalogues, newspaper advertising, and similar purposes. These electrotypes are from good wood cuts and should give satisfactory results on all grades of paper. They measure 2 1-4" or under, the longer way.

We will furnish any of the three sizes mentioned above as desired, but these are the **only** sizes which we can provide. Only new electrotypes from these cuts are sent out.



## Micrometer Calipers.

These Calipers are graduated to read to thousandths of an inch, but one-half and one-quarter thousandths are readily estimated. Some of the calipers have verniers by which sizes can be obtained to ten-thousandths. We also furnish calipers to read to hundredths of a millimetre.



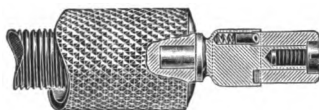
The chief mechanical principle embodied in the construction is that of a screw free to move in a fixed nut. An opening, to receive the work to be measured, is afforded by the backward movement of the screw and the size of the opening is indicated by the graduations.

The pitch of the screw, C, is forty to the inch. The graduation of the hub, A, in a line parallel to the axis of the screw, is forty to the inch and is figured 0, 1, 2, etc., every fourth division, representing 0, .100", .200" etc. As the graduation conforms to the pitch of the screw, each division equals the longitudinal distance traversed by the screw in one complete rotation and shows that the caliper has been opened one-fortieth or .025 of an inch. The beveled edge of the sleeve, D, is graduated into twenty-five parts and figured every fifth division, 0, 5, 10, 15, 20. Each division, when passing the line of graduations on the hub, indicates that the screw has made one twenty-fifth of a turn and the opening of the caliper increased one twenty-fifth of one-fortieth, or one-thousandth of an inch.

Hence, to read the caliper, multiply the number of divisions visible on the scale of the hub by twenty-five and add the number of divisions on the scale of the sleeve from zero to the line coincident with the line of graduations on hub.

## Ratchet Stop for Micrometer Calipers.

1



**For Micrometer Calipers with Ratchet Stop  
add 50 cents to the regular price.**

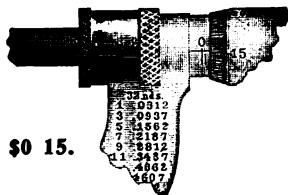
This Ratchet Stop can be furnished with any of our Micrometer Calipers. It is found convenient where a number of measurements have to be quickly taken, as it enables the objects measured to be subjected to the same degree of pressure.

In opening the tool, the pawl positively engages the ratchet so that it cannot slip by, thus making the Ratchet Stop positive in its return.

The ratchet and pawl are hardened.

## Spindle Protector No. 1 for Micrometer Calipers.

Patented August 11, 1914



**Price, \$0 15.**

This Spindle Protector is a new attachment which will fit any of our one inch Micrometers except the Rex Micrometer: also Micrometers Nos. 30 to 53 inclusive listed on the following pages.

It consists of a metal cap containing a felt washer which fits tightly over the spindle in the manner shown above. It protects the spindle bearing from dust, emery grit, etc., without interfering with the action of the spindle or the clamp ring.

The capacity of the Caliper is slightly lessened by the application of the Protector. When ordering, customer should give the diameter of the micrometer frame, as the Protector is made in three sizes, .460" to .462", .463" to .465" and .467" to .469".



## Micrometer Caliper No. 2.

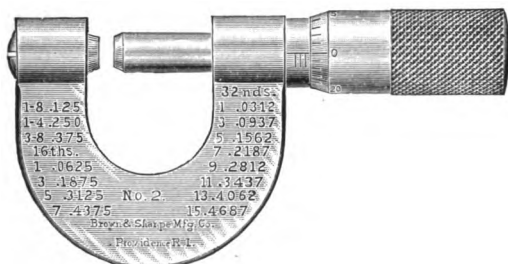
ENGLISH OR METRIC MEASURE.

Range, 0 to 1-2" or 0 to 13 m/m.

Price, \$4 50.

With Ratchet Stop, \$5 00.

Morocco Case, \$0 65.



This Caliper is shown full size and measures all sizes less than one-half inch by 1000ths of an inch. This Caliper is also made to measure all sizes less than 13 millimetres by 100ths of a millimetre. When so made the table of decimal equivalents is omitted.

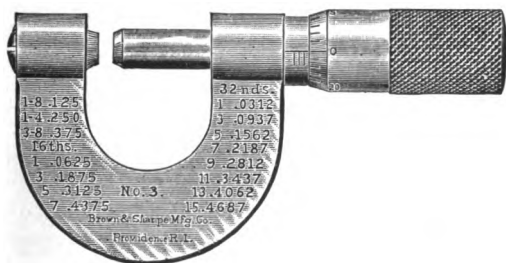
## Micrometer Caliper No. 3.

Range, 0 to 1-2'.

Price, \$5 50.

With Ratchet Stop, \$6 00.

Morocco Case, \$0 65.



This Caliper differs from Micrometer Caliper No. 2, English, only in being graduated to read to ten-thousandths, as well as thousandths of an inch.

## Micrometer Caliper No. 4.

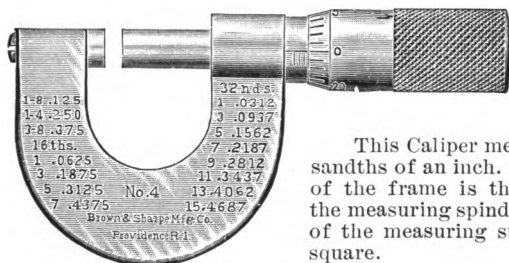
ENGLISH OR METRIC MEASURE.

Range, 0 to 1-2" or 0 to 13 m/m.

Price, \$4 50.

With Ratchet Stop, \$5 00.

Morocco Case, \$0 65.



This Caliper measures by thousandths of an inch. The outer end of the frame is the same size as the measuring spindle and the edges of the measuring surfaces are left square.

**7 Metric Measure.** This Caliper is also made to measure all sizes less than thirteen millimetres by hundredths of a millimetre. When so made the table of decimal equivalents is omitted.

## Micrometer Caliper No. 5.

ENGLISH OR METRIC MEASURE.

Range, 0 to 1-2" or 0 to 13 m/m.

Price, \$5 00.

With Ratchet Stop, \$5 50.

Morocco Case, \$0 65.

Patented December 30, 1902.

This Caliper differs from Micrometer Caliper No. 4, only in having a Clamp Ring which clamps the spindle and preserves the setting.

## Micrometer Caliper No. 6.

Range, 0 to 1-2".

Price, \$5 50.

With Ratchet Stop, \$6 00.

Morocco Case, \$0 65.

This Caliper differs from Micrometer Caliper No. 4, English, only in being graduated to read to ten-thousandths as well as thousandths of an inch.

## Micrometer Caliper No. 7.

Range, 0 to 1-2".

Price, \$6 00.

With Ratchet Stop, \$6 50.

Morocco Case, \$0 65.

Patented December 30, 1902.

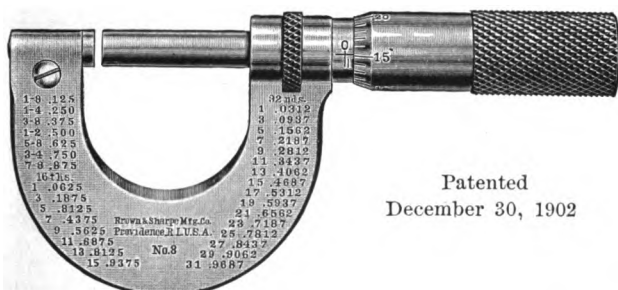
This Caliper differs from Micrometer Caliper No. 6, only in having a Clamp Ring which clamps the spindle and preserves the setting.

## Micrometer Caliper No. 8.

ENGLISH OR METRIC MEASURE.

Range, 0 to 1" or 0 to 25 m/m.

Price, \$6 00. With Ratchet Stop, \$6 50. Morocco Case, \$0 65.



Patented  
December 30, 1902

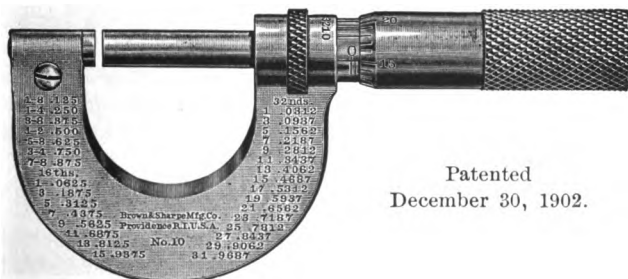
This Caliper measures all sizes less than an inch by thousandths of an inch. Every Caliper is provided with a **Clamp Ring** which clamps the spindle and preserves the setting.

**Metric Measure.** This Caliper is also made to measure all sizes less than 25 millimetres by hundredths of a millimetre. When so made, the table of decimal equivalents is omitted.

## Micrometer Caliper No. 10.

Range, 0 to 1".

Price, \$7 00. With Ratchet Stop, \$7 50. Morocco Case, \$0 65.



Patented  
December 30, 1902.

This Caliper differs from Micrometer Caliper No. 8, only in being graduated to read to **ten-thousandths** of an inch by a **Vernier** on the front of the barrel.

Every Caliper is provided with a **Clamp Ring** which clamps the spindle and preserves the setting.

## Rex Micrometer Caliper.

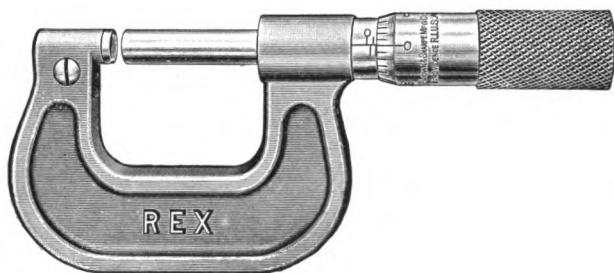
ENGLISH OR METRIC MEASURE.

Range, 0 to 1" or 0 to 25 m/m.

Price, \$4 00.

With Ratchet Stop, \$4 50.

Morocco Case, \$0 65.



This Caliper is made to meet the demand for an inexpensive yet accurate measuring tool.

The frame is drop forged and of a type combining rigidity and strength with lightness and ease of handling.

The bearing parts and measuring surfaces are hardened, and means are provided to compensate for wear of measuring screw and anvil.

The graduations on the hub that run parallel to the axis of the screw run alternately one above and one below the measuring line. Those above the measuring line are for 0, 50, 100, 150, etc.; those below are for 25, 75, 125, etc.

This is an important feature, as it facilitates reading the Caliper at a glance. The cut illustrates the style of graduations.

The Caliper is made to measure all sizes less than one inch by thousandths of an inch.

**Metric Measure.** This Caliper is also made to measure all sizes less than twenty-five millimetres by hundredths of a millimetre.

# Micrometer Caliper, No. 12.

ENGLISH OR METRIC MEASURE

Range, 0 to 1" or 0 to 25 m/m.

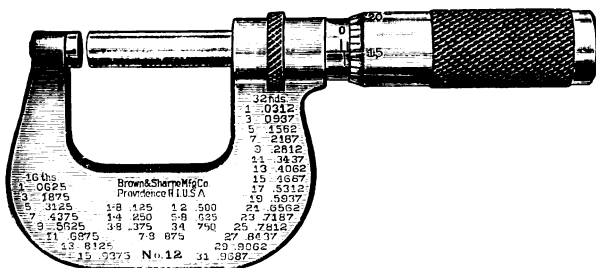
12

Price, \$6 00.

With Ratchet Stop, \$6 50.

Morocco Case, \$0 65.

Patented December 30, 1902.



This Caliper is new in design, and differs from the others in the type of frame, and method of graduating. The end of the frame is tapered so that the thickness at the anvil is only 11-32" allowing the Caliper to be used in places where the usual style of micrometer will not enter.

The graduations on the hub that run parallel to the axis of the screw run alternately one above and one below the measuring line. Those above the measuring line are for 0, 50, 100, 150, etc.; those below are for 25, 75, 125, etc. This is an important feature, as it facilitates reading the Caliper at a glance. The cut illustrates the style of graduations.

This Caliper measures all sizes less than one inch by thousandths of an inch. The adjustment of the measuring screw to compensate for wear is made by a taper nut.

Every Caliper is provided with a **Clamp Ring**, which clamps the spindle and preserves the setting.

**Metric Measure.** The Caliper is also made to measure all sizes less than twenty-five millimetres by hundredths of a millimetre.

This Caliper is regularly furnished with a square anvil, as illustrated, but can be furnished, without extra cost, when desired, with **Rounded Anvil for Measuring Tubing** similar to that of the No. 225 Micrometer Caliper.

## Micrometer Caliper No. 15.

ENGLISH OR METRIC MEASURE.

Range, 0 to 1" or 0 to 25 m/m.

**15** Price, \$5 50. With Ratchet Stop, \$6 00. Morocco Case, \$0 65.

**16**



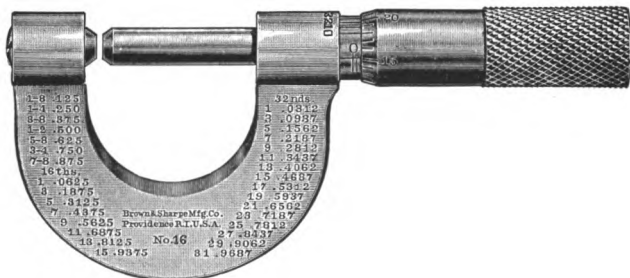
This Caliper measures all sizes less than an inch by thousandths of an inch.

**Metric Measure.** This Caliper is also made to measure all sizes less than twenty-five millimetres by hundredths of a millimetre. When so made, the table of decimal equivalents is omitted.

## Micrometer Caliper No. 16.

Range, 0 to 1".

Price, \$6 50. With Ratchet Stop, \$7 00. Morocco Case, \$0 65.



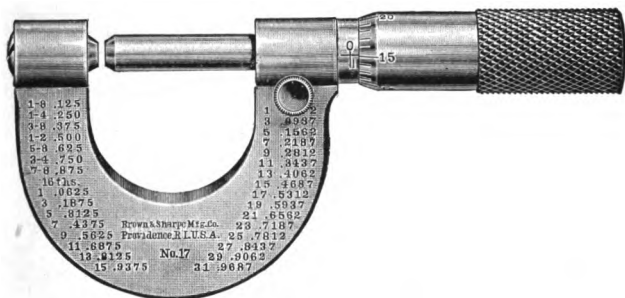
This Caliper differs from Micrometer Caliper No. 15, English, only in being graduated to read to ten-thousandths as well as thousandths of an inch.

## Micrometer Caliper No. 17.

ENGLISH OR METRIC MEASURE.

Range, 0 to 1" or 0 to 25 m/m.

Price, \$6 00. With Ratchet Stop, \$6 50. Morocco Case, \$0 65.



17

18

This Caliper differs from Micrometer Caliper No. 15, only in having a **Clamp Screw** by which the measuring spindle can be held in any desired position.

**Metric Measure.** This Caliper is also made to measure all sizes less than twenty-five millimetres by hundredths of a millimetre. When so made, the table of decimal equivalents is omitted.

**Wooden Handle.** This Caliper is furnished when desired, with a wooden handle attached to the bow. The handle is about 2 3/4" long and 1" largest diameter. When so fitted, the clamp screw is provided with wings instead of a knurled head.

Price, \$1 50 in addition to prices given above.

## Micrometer Caliper No. 18.

Range, 0 to 1".

Price, \$7 00. With Ratchet Stop, \$7 50. Morocco Case, \$0 65.

This Caliper differs from Micrometer Caliper No. 17, English Measure, only in being graduated to read to **ten-thousandths** as well as thousandths of an inch.

## Soft Leather Cases.

FOR MICROMETER CALIPERS.

Price, 25 Cents.

We carry in stock Soft Leather Cases for Micrometer Calipers. These Cases are convenient for those who wish to carry a Micrometer Caliper in the pocket. They are made to hold Micrometer Calipers of 1-2", 1" or 2" capacity. When ordering give size required.

## Micrometer Caliper No. 19.

ENGLISH OR METRIC MEASURE.

Range, 0 to 1" or 0 to 25 m/m.

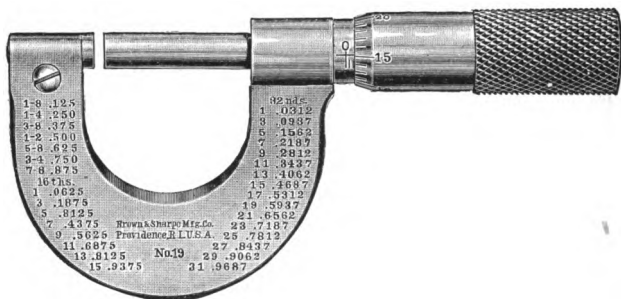
Price, \$5 50.

With Ratchet Stop, \$6 00.

Morocco Case, \$0 65.

19

20



This Caliper measures all sizes less than an inch by thousandths of an inch. The outer end of the frame is the same size as the measuring spindle and the edges of the measuring surfaces are left square.

**Metric Measure.** This Caliper is also made to read to hundredths of a millimetre.

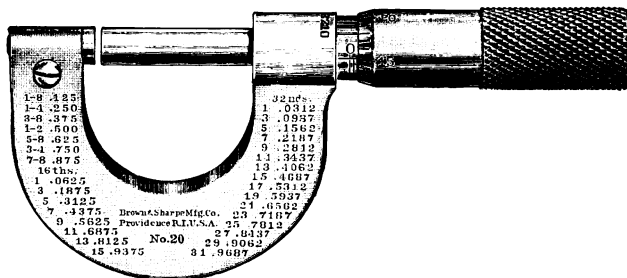
## Micrometer Caliper No. 20.

Range, 0 to 1".

Price, \$6 50.

With Ratchet Stop, \$7 00.

Morocco Case, \$0 65.



This Caliper differs from Micrometer Caliper No. 19, English, only in being graduated to read to ten-thousandths as well as to thousandths of an inch.



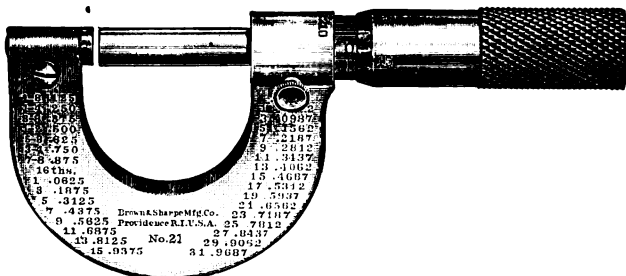
## Micrometer Caliper No. 21.

Range 0 to 1".

Price, \$7 00.

With Ratchet Stop, \$7 50.

Morocco Case, \$0 65.



21

22

This Caliper measures all sizes less than an inch by ten-thousandths, as well as thousandths of an inch. The outer end of the frame is the same size as the measuring spindle and the edges of the measuring surfaces are not beveled but are left square. It will gauge under a shoulder or measure a small projection on a plane surface.

A Clamp Screw is provided by which the measuring spindle can be held in any desired position.

## Micrometer Caliper No. 22.

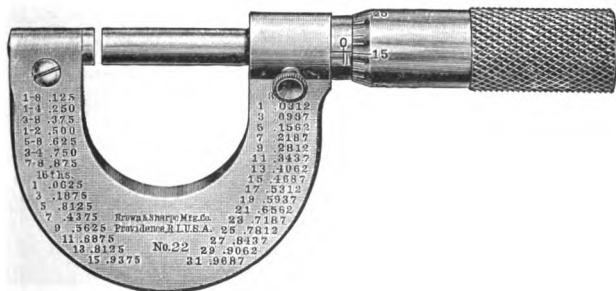
ENGLISH OR METRIC MEASURE.

Range, 0 to 1" or 0 to 25 m/m.

Price, \$6 00.

With Ratchet Stop, \$6 50.

Morocco Case, \$0 65.

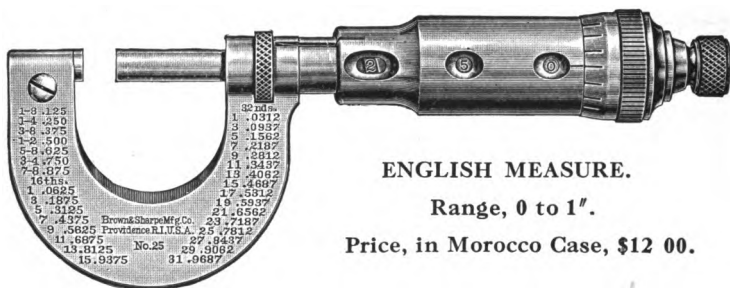


This Caliper differs from Micrometer Caliper No. 19, only in having a Clamp Screw, which clamps the spindle and preserves the setting.

## Direct Reading Micrometer Caliper No. 25.

25

Patented Dec. 30, 1902; Aug. 22, 1911; May 5, 1914.



This Micrometer Caliper presents an entirely new feature in that thousandths of an inch can be read in exact figures, without the necessity of calculation with the aid of graduation lines. The mechanical principle of a screw free to move in a fixed nut, used in our regular line of Micrometer Calipers, and with which mechanics are familiar, is retained.

The figures showing in the opening nearest the frame indicate the movement of the spindle by tenths of an inch. Those in the next opening register the movement by hundredths of an inch, while the figures in the last opening indicate the movement by thousandths. In addition, the thimble on the end of the sleeve is graduated in connection with a line on the sleeve to read to thousandths of an inch. By means of these lines, fractional parts of a thousandth may be estimated.

The registering mechanism is so constructed that the dials are positively locked and the Micrometer cannot get out of adjustment and read incorrectly.

Parts not subject to wear or stress are made of an alloy to eliminate weight. All other parts are made of steel, the spindle and anvil being hardened. The Caliper may be adjusted to compensate for wear the same as on our regular line of Micrometer Calipers. It is regularly furnished with a ratchet stop.

## Micrometer Caliper No. 30.

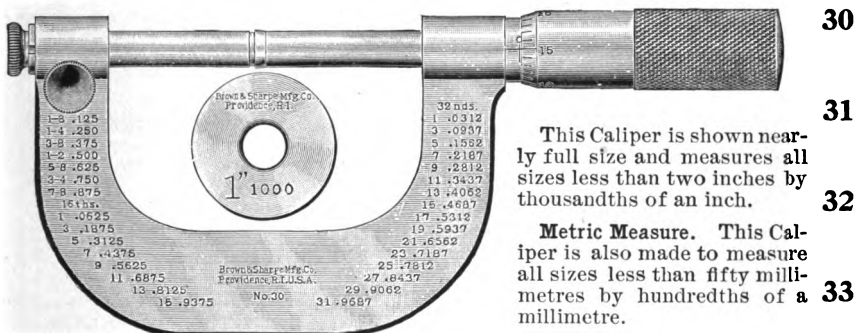
**ENGLISH OR METRIC MEASURE.**

**Range, 0 to 2" or 0 to 50 m/m.**

**Price, \$8 00.**

**With Ratchet Stop, \$8 50.**

**Morocco Case, \$0 75.**



When so made the table of decimal equivalents is omitted.

## Micrometer Caliper No. 31.

**ENGLISH OR METRIC MEASURE.**

**Range, 0 to 2" or 0 to 50 m/m.**

**Price, \$8 50.**

**With Ratchet Stop, \$9 00.**

**Morocco Case. \$0 75.**

**This Caliper differs from Micrometer Caliper No. 30 only in having a Clamp Screw which clamps the spindle and preserves the setting.**

## Micrometer Caliper No. 32.

**Range, 0 to 2".**

**Price, \$9 00.**

**With Ratchet Stop, \$9 50.**

**Morocco Case, \$0 75.**

This Caliper differs from Micrometer Caliper No. 30 only in being graduated to read to ten thousandths as well as thousandths of an inch.

## Micrometer Caliper No. 33.

**Range, 0 to 2".**

**Price, \$9 50.**

**With Ratchet Stop, 10 00.**

**Morocco Case, \$0 75.**

**This Caliper differs from Micrometer Caliper No. 32 only in having a Clamp Screw which clamps the spindle and preserves the setting.**

**A Standard Gauge**, to be used in adjusting the Caliper, is sent with each one of the above.

## Micrometer Caliper No. 38.

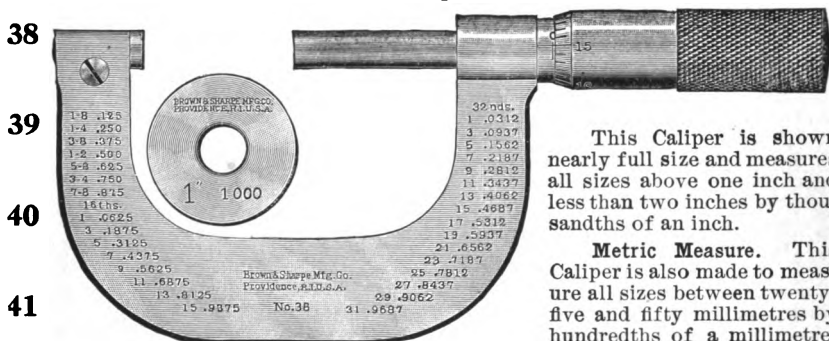
ENGLISH OR METRIC MEASURE.

Range, 1" to 2" or 25 m/m to 50 m/m.

Price, \$6 00.

With Ratchet Stop, \$6 50.

Morocco Case, \$0 75.



This Caliper is shown nearly full size and measures all sizes above one inch and less than two inches by thousandths of an inch.

**Metric Measure.** This Caliper is also made to measure all sizes between twenty-five and fifty millimetres by hundredths of a millimetre.

When so made, the table of decimal equivalents is omitted.

## Micrometer Caliper No. 39.

ENGLISH OR METRIC MEASURE.

Range, 1" to 2" or 25 m/m to 50 m/m.

Price, \$6 50.

With Ratchet Stop, \$7 00.

Morocco Case, \$0 75.

This Caliper differs from Micrometer Caliper No. 38, only in having a Clamp Screw which clamps the spindle and preserves the setting.

## Micrometer Caliper No. 40.

Range, 1" to 2".

Price, \$7 00.

With Ratchet Stop, \$7 50.

Morocco Case, \$0 75.

This Caliper differs from Micrometer Caliper No. 38, English measure, only in being graduated to read to ten-thousandths as well as thousandths of an inch.

## Micrometer Caliper No. 41.

Range, 1" to 2".

Price, \$7 50.

With Ratchet Stop, \$8 00.

Morocco Case, \$0 75.

This Caliper differs from Micrometer Caliper No. 40, only in having a Clamp Screw which clamps the spindle and preserves the setting.

A Standard Gauge to be used in adjusting the Caliper, is sent with each one of the above.

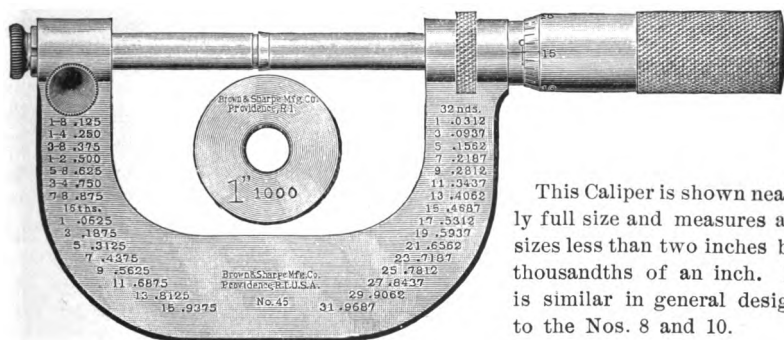
## Micrometer Caliper No. 45.

ENGLISH OR METRIC MEASURE.

Range, 0 to 2" or 0 to 50 m/m.

Price, \$8 50. With Ratchet Stop, \$9 00. Morocco Case, \$0 75.

Patented December 30, 1902.



This Caliper is shown nearly full size and measures all sizes less than two inches by thousandths of an inch. It is similar in general design to the Nos. 8 and 10.

**Metric Measure.** This Caliper is also made to measure all sizes less than fifty millimetres by hundredths of a millimetre.

When so made the table of decimal equivalents is omitted.

Every Caliper is provided with a **Clamp Ring** which clamps the spindle and preserves the setting.

## Micrometer Caliper No. 46.

Range, 0 to 2".

Price, \$9 50. With Ratchet Stop, \$10 00. Morocco Case, \$0 75.

Patented December 30, 1902.

This Caliper differs from Micrometer Caliper No. 45, English Measure, only in being graduated to read to **ten-thousandths** as well as thousandths of an inch.

A **Standard Gauge**, to be used in adjusting the Caliper, is sent with each one of the above.

## Micrometer Caliper No. 47.

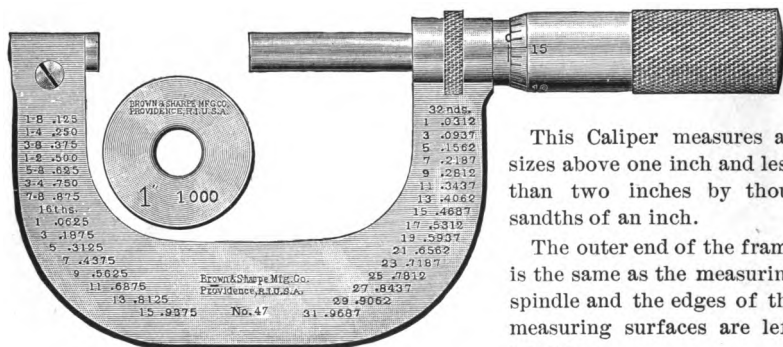
ENGLISH OR METRIC MEASURE.

Range, 1' to 2' or 25 m/m to 50 m/m.

**47** Price, \$6 50. With Ratchet Stop, \$7 00. Morocco Case, \$0 75.

Patented December 30, 1902.

**48**



This Caliper measures all sizes above one inch and less than two inches by thousandths of an inch.

The outer end of the frame is the same as the measuring spindle and the edges of the measuring surfaces are left square.

Every Caliper is provided with a **Clamp Ring** which clamps the spindle and preserves the setting.

**Metric Measure.** This Caliper is also made to measure all sizes above 25 and less than 50 millimetres by hundredths of a millimetre. When so made, the table of decimal equivalents is omitted.

## Micrometer Caliper No. 48.

Range, 1' to 2'.

Price, \$7 50. With Ratchet Stop, \$8 00. Morocco Case, \$0 75.

Patented December 30, 1902.

This Caliper differs from Micrometer Caliper No. 47, English measure, only in being graduated to read to ten-thousandths as well as thousandths of an inch.

A **Standard Gauge**, to be used in adjusting the Caliper, is sent with each of the above.

## Micrometer Caliper No. 50.

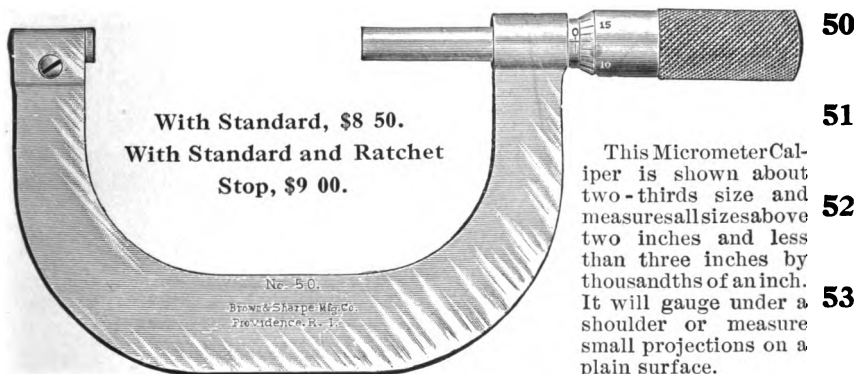
ENGLISH OR METRIC MEASURE.

Range, 2" to 3" or 50 m/m to 75 m/m.

Price, \$7 50.

With Ratchet Stop, \$8 00.

Morocco Case, \$1 00.



With Standard, \$8 50.

With Standard and Ratchet  
Stop, \$9 00.

This Micrometer Caliper is shown about two-thirds size and measures all sizes above two inches and less than three inches by thousandths of an inch. It will gauge under a shoulder or measure small projections on a plain surface.

**Metric Measure.** This Caliper is also made to measure all sizes above fifty and less than seventy-five millimetres by hundredths of a millimetre.

## Micrometer Caliper No. 51.

Price, \$8 50.

With Ratchet Stop, \$9 00.

With Standard, \$9 50.

With Standard and Ratchet Stop, \$10 00.

Morocco Case, \$1 00.

This Caliper differs from Micrometer Caliper No. 50, only in reading to ten-thousandths.

## Micrometer Caliper No. 52.

ENGLISH OR METRIC MEASURE.

Range, 2" to 3" or 50 m/m to 75 m/m.

Price, \$8 00.

With Ratchet Stop, \$8 50.

With Standard, \$9 00.

With Standard and Ratchet Stop, \$9 50.

Morocco Case, \$1 00.

Patented December 30, 1902.

This Caliper differs from Micrometer Caliper No. 50, only in having a Clamp Ring by which the measuring spindle can be held in any desired position.

## Micrometer Caliper No. 53.

Price, \$9 00.

With Ratchet Stop, \$9 50.

With Standard, \$10 00.

With Standard and Ratchet Stop, \$10 50.

Morocco Case, \$1 00.

Patented December 30, 1902.

This Caliper differs from Micrometer Caliper No. 52, only in reading to ten-thousandths.

Furnished with Standards unless otherwise ordered.

# Micrometer Caliper No. 55.

ENGLISH OR METRIC MEASURE.

Range, 3" to 6" length, 6" dia.

or 75 m/m to 150 m/m length, 150 m/m dia.

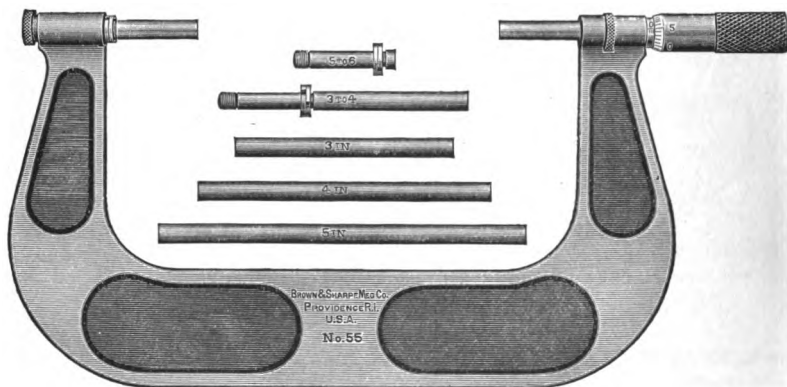
55

Price, with Standards, \$14 00.

With Ratchet Stop, \$14 50.

Price, without Standards, \$10 00.

With Ratchet Stop, \$10 50.



This Micrometer Caliper is shown about one-half size. It measures all sizes from 3" to 6" by thousandths of an inch.

Three anvils are furnished; the long anvil measures from 3" to 4", the intermediate from 4" to 5", and the short one from 5" to 6". Each anvil is provided with separate means of adjustment for wear. They are easily and quickly inserted in the frame and are held solidly to their bearings by a knurled nut.

Means of adjustment for the measuring screw are also provided.

**Metric Measure.** This Caliper is also made to measure all sizes above 75 millimetres and less than 150 millimetres by hundredths of a millimetre.

Every Caliper is provided with a **Clamp Ring** which clamps the spindle and preserves the setting.

## Standards.

A set of three Standards is furnished unless otherwise ordered.

Price, per set, \$4 00.



# Micrometer Caliper No. 57.

ENGLISH OR METRIC MEASURE.

Range, 6" to 12" length, 12" dia.

or 150 m/m to 300 m/m length, 300 m/m dia.

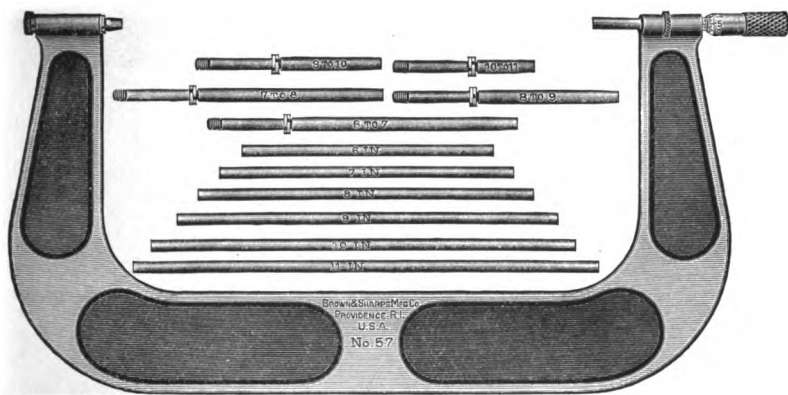
57

Price, with Standards, \$31 10.

With Ratchet Stop, \$31 60.

Price, without Standards, \$20 00.

With Ratchet Stop, \$20 50.



This Caliper differs from Micrometer Caliper No. 55, only in that it measures all sizes from 6" to 12" by **thousandths** of an inch.

Six anvils are furnished and measure respectively 11" to 12", 10" to 11", 9" to 10", 8" to 9", 7" to 8" and 6" to 7".

Each anvil is provided with separate means of adjustment for wear.

**Metric Measure.** This Caliper is also made to measure all sizes above 150 and less than 300 millimetres by hundredths of a millimetre.

Every Caliper is provided with a **Clamp Ring**, which clamps the spindle and preserves the setting.

## Standards.

A set of six Standards is furnished unless otherwise ordered.

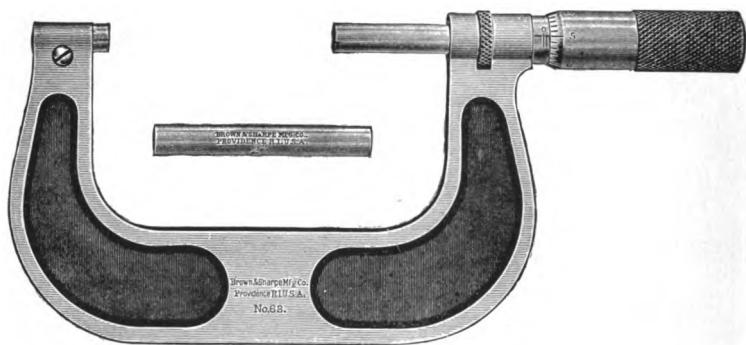
Price, per set, \$11 10.

## Micrometer Calipers.

Nos. 61 to 88

ENGLISH OR METRIC MEASURE.

Patented Dec. 30, 1902.



These Micrometer Calipers, listed on opposite page, are made to meet the demand for inexpensive, yet accurate measuring tools. They are more convenient for general use than the bar Micrometer or Vernier, as they can be more readily set for the different measurements and are more easily handled where rapid measurements are required.

The frame is of I section, thus combining the greatest rigidity and strength with lightness.

They are provided with a **Clamp Ring** which clamps the spindle and preserves the setting.

**Metric Measure.** These Calipers are also made to read to hundredths of a millimetre.

These Calipers are furnished with Standards unless otherwise ordered.

# Micrometer Calipers.

## Nos. 61 to 88.

(Continued.)

### ENGLISH OR METRIC MEASURE.

No.	Range.				Price, without Standards.	Price, with Standards.
61	1" to	2" or	25 m/m to	50 m/m	\$5 50	\$6 50
*62	1 to	2			6 50	7 50
63	2 to	3 or	50	to 75	6 50	7 50
*64	2 to	3			7 50	8 50
65	3 to	4 or	75	to 100	7 00	8 15
67	4 to	5 or	100	to 125	7 75	9 10
69	5 to	6 or	125	to 150	8 50	10 00
71	6 to	7 or	150	to 175	9 50	11 10
72	7 to	8 or	175	to 200	10 50	12 20
73	8 to	9 or	200	to 225	11 50	13 30
74	9 to	10 or	225	to 250	12 50	14 40
75	10 to	11 or	250	to 275	13 50	15 50
76	11 to	12 or	275	to 300	14 50	16 60
77	12 to	13 or	300	to 325	16 00	18 20
78	13 to	14 or	325	to 350	17 50	19 80
79	14 to	15 or	350	to 375	19 50	21 90
80	15 to	16 or	375	to 400	21 50	24 00
81	16 to	17 or	400	to 425	23 50	26 10
82	17 to	18 or	425	to 450	25 50	28 20
83	18 to	19 or	450	to 475	27 50	30 30
84	19 to	20 or	475	to 500	30 50	33 40
85	20 to	21 or	500	to 525	34 00	37 00
86	21 to	22 or	525	to 550	37 00	40 10
87	22 to	23 or	550	to 575	41 00	44 20
88	23 to	24 or	575	to 600	45 00	48 30

\*62 and 64 differ from the others only in reading to ten-thousandths.

For Ratchet Stop, add \$0 50 to above prices.

**Morocco Cases** can be furnished as follows: Nos. 61 and 62, \$0 75 each;

Nos. 63 and 64, \$1 00 each; No. 65, \$1 50; No. 67, \$1 75; No. 69, \$2 00

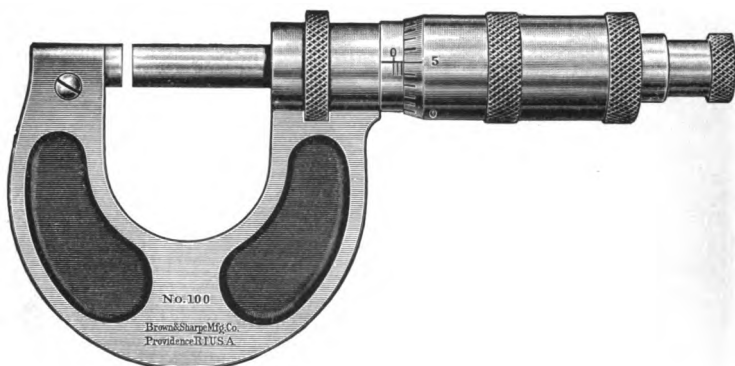
# Heavy Micrometer Caliper, No. 100.

ENGLISH OR METRIC.

100

Range, 0 to 1" or 0 to 25 m/m.

Patented Dec. 30, 1902.



Price, \$7 50.

Morocco Case, \$0 75.

These Calipers are designed to meet the demands of constant and severe usage under adverse conditions, such as the dirt and moisture of grinding rooms or wherever it is desired to take frequent measurements with the clamp ring set.

They are made with a frame of heavy I section with a much heavier spindle and threaded portion than is usually put in calipers. This permits greater stiffness and insures longer life to the screw under adverse conditions because of larger bearing surface for the threads.

The bearing parts and measuring surfaces are hardened to prevent wear and means are provided to compensate for wear.

These Calipers are furnished with ratchet stops and a clamp ring to firmly hold the spindle and preserve the setting.

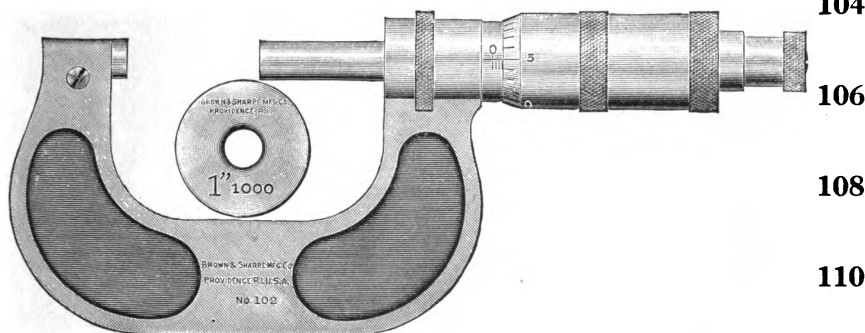
# Heavy Micrometer Calipers,

## Nos. 102, 104, 106, 108 and 110.

ENGLISH OR METRIC MEASURE.

102

Patented December 30, 1902.



No. 102, Range 1" to 2" or 25 to 50 m/m.

Price, \$8 50.

With Standard, \$9 50.

Morocco Case, \$1 00.

No. 104, Range 2" to 3" or 50 to 75 m/m.

Price, \$9 50.

With Standard, \$10 50.

Morocco Case, \$1 25.

No. 106, Range 3" to 4" or 75 to 100 m/m.

Price, \$10 50.

With Standard, \$11 65.

Morocco Case, \$1 75.

No. 108, Range 4" to 5" or 100 to 125 m/m.

Price, \$11 50.

With Standard, \$12 85.

Morocco Case, \$2 00.

No. 110, Range 5" to 6" or 125 to 150 m/m.

Price, \$12 50.

With Standard, \$14 00.

Morocco Case, \$2 25.

These Calipers are made to meet the demands of constant and severe usage under adverse conditions. They are provided with ratchet stops and clamp rings which clamp the spindles and preserve the settings.

## Micrometer Caliper Sets.

**Sent with Standards, in Case, and without Ratchet Stops unless otherwise ordered.**



### Set No. 133.

The Micrometer Caliper Sets listed on the opposite page contain tools selected from our regular line with the view of making up inexpensive yet accurate and convenient sets of reference tools for inspecting finished product as well as for general shop use.

Set No. 133 shown above and listed on the opposite page includes Calipers Nos. 12, 61 and 63 and forms a selection of particularly economical and reliable measuring tools. In this set, as well as in Sets Nos. 130 and 131, the Rex 1" Micrometer Caliper can be furnished in place of the 1" Micrometer Caliper at the reductions in prices noted opposite.

**Metric Measure.** The Calipers in Sets Nos. 130, 131, 133 and 134 are also made to read to hundredths of a millimetre.

## Micrometer Caliper Set, No. 130.

ENGLISH OR METRIC MEASURE.

3 Calipers, measuring from 0 to 3" or 0 to 75 m/m.

Price, \$19 00. With Standards, \$20 00. With Ratchet Stops, \$20 50.

With Standards and Ratchet Stops, \$21 50. Case, \$2 00 extra.

This Set consists of Micrometer Calipers Nos. 19, 38 and 50, found on preceding pages. The **Rex 1" Micrometer Caliper** can be furnished in place of the No. 19 if desired, at a reduction of \$1 50 from the above prices. 130

## Micrometer Caliper Set, No. 131.

ENGLISH OR METRIC MEASURE.

3 Calipers, measuring from 0 to 3" or 0 to 75 m/m.

Price, \$20 50. With Standards, \$21 50. With Ratchet Stops, \$22 00.

With Standards and Ratchet Stops, \$23 00. Case, \$2 00 extra. 132

This Set differs from Micrometer Set, No. 130, only in being provided with **Clamp Rings** which clamp the spindles and preserve the settings. It consists of Micrometer Calipers Nos. 8, 47 and 52, found on preceding pages. The **Rex 1" Micrometer Caliper** can be furnished in place of the No. 8 Caliper at a reduction of \$2 00 from the above prices. 133

## Micrometer Caliper Set, No. 132.

ENGLISH MEASURE.

3 Calipers, measuring from 0 to 3".

Price, \$23 50. With Standards, \$24 50. With Ratchet Stops, \$25 00.

With Standards and Ratchet Stops, \$26 00. Case, \$2 00 extra.

This Set differs from Micrometer Set, No. 131, only in being graduated to read to ten-thousandths as well as thousandths of an inch. It consists of Micrometer Calipers Nos. 10, 48 and 53, found on preceding pages. 134

## Micrometer Caliper Set, No. 133.

ENGLISH OR METRIC MEASURE.

3 Calipers, measuring from 0 to 3" or 0 to 75 m/m.

Price, \$18 00. With Standards, \$20 00. With Ratchet Stops, \$19 50.

With Standards and Ratchet Stops, \$21 50. Case, \$2 00 extra.

This Set is shown and described on the opposite page. The **Rex 1" Micrometer Caliper** can be furnished in place of the No. 12 Caliper at a reduction of \$2 00 from the above prices.

## Micrometer Caliper Set, No. 134.

ENGLISH OR METRIC MEASURE.

3 Calipers, measuring from 0 to 3" or 0 to 75 m/m.

Price, with Ratchet Stops, \$25 50.

With Standards and Ratchet Stops, \$27 50. Case, \$2 00 extra.

This Set is made up of Heavy Micrometer Calipers and consists of Calipers Nos. 100, 102 and 104, found on preceding pages.

# Micrometer Caliper Set, No. 135.

ENGLISH OR METRIC MEASURE.

135

6 Calipers, measuring from 0 to 6", or 0 to 150 m/m.

Price, \$41 25. With Ratchet Stops, \$44 25. With Standards, \$47 25.  
With Standards and Ratchet Stops, \$50 25. With Case, \$4 00 extra.



**Sent with Standards, in Case, and without Ratchet Stops  
unless otherwise ordered.**

This set of Micrometer Calipers forms an inexpensive set of accurate and trustworthy reference tools for inspecting the finished product as well as for general shop use. For many classes of work they are more convenient than the Vernier Caliper.

The 1" caliper is the standard type with decimal equivalents stamped on the frame and is provided with a clamp ring; the 2", 3", 4", 5" and 6" calipers have frames of I section, which combines the greatest rigidity and lightness.

Each micrometer is graduated to read to thousandths of an inch. Each set is neatly arranged in a substantial case, lined with velvet and covered with leather.

**Metric Measure.** This set is also made to measure all sizes less than 150 millimetres by hundredths of a millimetre.

The **Rex 1" Micrometer Caliper** can be furnished in place of the 1" caliper shown, at a reduction of \$2 00 from the above prices.



## Micrometer Caliper Set, No. 136.

### ENGLISH MEASURE.

6 Calipers, measuring from 0 to 6".

Price, \$48 75. With Standards, \$54 75. With Ratchet Stops, \$51 75.

With Standards and Ratchet Stops, \$57 75. Case, \$4 00 extra.

This Set differs from Micrometer Set, No. 135, only in being graduated to read to ten-thousandths of an inch.

136

## Micrometer Caliper Set, No. 137.

137

### ENGLISH OR METRIC MEASURE.

6 Calipers, measuring from 6" to 12" or 150 m/m to 300 m/m.

Price, \$72 00. With Standards, \$83 10. With Ratchet Stops, \$75 00.

With Standards and Ratchet Stops, \$86 10.

138

## Micrometer Caliper Set, No. 138.

139

### ENGLISH OR METRIC MEASURE.

11 Calipers, measuring from 1" to 12" or 25 m/m to 300 m/m.

Price, \$107 25. With Standards, \$124 35. With Ratchet Stops, \$112 75.

With Standards and Ratchet Stops, \$129 85.

140

## Micrometer Caliper Set, No. 139.

141

### ENGLISH OR METRIC MEASURE.

4 Calipers, measuring from 12" to 16" or 300 m/m to 400 m/m.

Price, \$74 50. With Standards, \$83 90. With Ratchet Stops, \$76 50.

With Standards and Ratchet Stops, \$85 90.

## Micrometer Caliper Set, No. 140.

### ENGLISH OR METRIC MEASURE.

4 Calipers, measuring from 16" to 20" or 400 m/m to 500 m/m.

Price, \$107 00. With Standards, \$118 00. With Ratchet Stops, \$109 00.

With Standards and Ratchet Stops, \$120 00.

## Micrometer Caliper Set, No. 141.

### ENGLISH OR METRIC MEASURE.

19 Calipers, measuring from 1" to 20" or 25 m/m to 500 m/m.

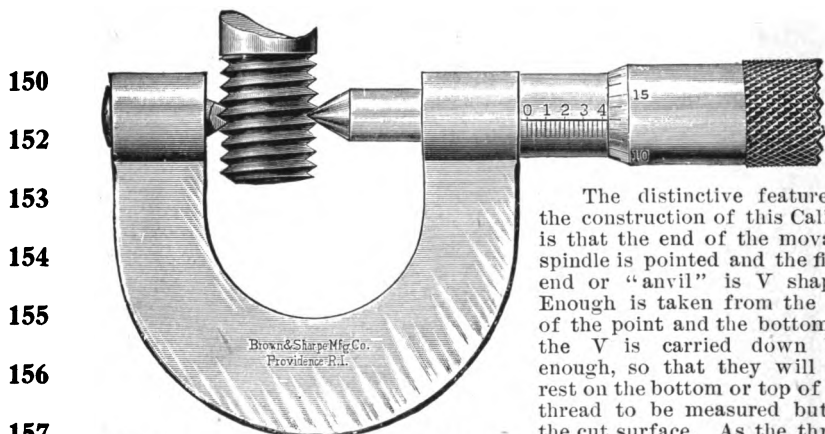
Price, \$288 75. With Standards, \$326 25. With Ratchet Stops, \$298 25.

With Standards and Ratchet Stops, \$335 75.

The above Sets, with the exception of No. 136, are neatly packed in substantial wooden cases. The Calipers are of the same style as those shown on pages 26 and 27. Standards are sent with Sets unless otherwise ordered.

# Screw Thread Micrometer Calipers.

Nos. 150, 152, 153, 154, 155, 156, 157, 158 and 159.



The distinctive feature in the construction of this Caliper is that the end of the movable spindle is pointed and the fixed end or "anvil" is V shaped. Enough is taken from the end of the point and the bottom of the V is carried down low enough, so that they will not rest on the bottom or top of the thread to be measured but on the cut surface. As the thread

itself is measured, it will be seen that the actual outside diameter of the piece does not enter into consideration.

As we measure one-half of the depth of the thread from the top, on each side, the diameter of the thread as indicated by the Caliper, or the pitch diameter, is the full size of the thread less the depth of one thread.

When the point and anvil are in contact the 0 represents a line drawn through the plane A B, and if the Caliper is opened, say to .500, it represents the distance of the two planes .500" apart.

Special Screw Thread Micrometers can usually be furnished upon receipt of information regarding form of thread, range of pitches to be measured and outside diameter of work to be calipered. Prices on application.

No.	Capacity.	Range.	Form of Thread.	Price.
150	1-2 in.	48 to 64 Thds. per in.	V and U. S. Threads	\$7 50
*152	1 in.	8 to 13 Thds. per in.		8 00
153	1 in.	14 to 20 Thds. per in.		8 00
154	1 in.	22 to 30 Thds. per in.	V & United States or Whitworth Standard	8 00
155	1 in.	32 to 40 Thds. per in.		8 00
156	2 in.	4 1/2 to 7 Thds. per in.		9 50
*157	2 in.	8 to 13 Thds. per in.		9 50
158	2 in.	14 to 20 Thds. per in.		9 50
159	2 in.	22 to 30 Thds. per in.		9 50

\*Whitworth Standard range 8 to 12 Threads per inch only.

These Calipers can also be furnished in metric sizes for V and U. S. or Whitworth Standards.

# Table

FOR USE IN CONNECTION WITH

## Brown & Sharpe Mfg. Co.'s Screw Thread Micrometer Caliper.

### READING OF CALIPER, OR PITCH DIAMETER.

$$\text{For "V" Threads} = D - \frac{.866}{N}$$

### "V" THREADS.

Diam.	Threads per Inch.	Caliper Reading or Pitch Diam.		Diam. *	Threads per Inch.	Caliper Reading or Pitch Diam.	
D	N	$D - \frac{.866}{N}$	$\frac{.866}{N}$	D	N	$D - \frac{.866}{N}$	$\frac{.866}{N}$
	64		.0135	1-4"	24	.2139	.0361
	62		.0140	1-4	20	.2067	.0433
	60		.0144	5-16	20	.2692	.0433
	58		.0149	5-16	18	.2644	.0481
	56		.0155	3-8	18	.3269	.0481
	54		.0160	3-8	16	.3209	.0541
	52		.0167	7-16	16	.3834	.0541
	50		.0173	7-16	14	.3756	.0619
	48		.0180	1-2	14	.4381	.0619
	46		.0188	1-2	13	.4334	.0666
	44		.0197	1-2	12	.4278	.0722
	42		.0206	9-16	14	.5006	.0619
	40		.0217	9-16	12	.4903	.0722
	38		.0228	5-8	11	.5463	.0787
	36		.0241	5-8	10	.5384	.0866
	34		.0255	11-16	10	.6009	.0866
	32		.0271	3-4	10	.6634	.0866
	30		.0289	7-8	9	.7788	.0962
	28		.0309	1	8	.8918	.1082
	26		.0333	1 1-8	8	1.0168	.1082
				1 1-4	7	1.1263	.1237
				1 1-2	6	1.3557	.1443

As there is no standard of diameter for the finer pitches, the columns for diameter and caliper reading, or pitch diameter, are left blank. The column on the right gives the number to be subtracted from the diameter to obtain the caliper reading, or pitch diameter.

\*These figures give the outside diameter for screws with threads cut theoretically sharp. As it is not practical to make these threads sharp the outside diameter will measure less than the figures given, the pitch diameter remaining the same.

The pitch diameter for taps should be larger than for screws.

# Table

FOR USE IN CONNECTION WITH

## Brown & Sharpe Mfg. Co.'s Screw Thread Micrometer Caliper.

### READING OF CALIPER, OR PITCH DIAMETER.

$$\text{For U. S. Threads} = D - \frac{.6495}{N}$$

### U. S. STANDARD THREADS.

Diam.	Threads per Inch.	Caliper Reading or Pitch Diam.		Diam.	Threads per Inch.	Caliper Reading or Pitch Diam.	
D	N	$D - \frac{.6495}{N}$	$\frac{.6495}{N}$	D	N	$D - \frac{.6495}{N}$	$\frac{.6495}{N}$
	64		.0101	1-4"	20	.2175	.0325
	62		.0105	5-16	18	.2764	.0361
	60		.0108	3-8	16	.3344	.0406
	58		.0112	7-16	14	.3911	.0464
	56		.0116	1-2	13	.4501	.0499
	54		.0120	9-16	12	.5084	.0541
	52		.0125	5-8	11	.566	.0590
	50		.0130	3-4	10	.6851	.0649
	48		.0135	7-8	9	.8029	.0721
	46		.0141	1	8	.9188	.0812
	44		.0148	1 1-8	7	1.0322	.0928
	42		.0155	1 1-4	7	1.1572	.0928
	40		.0162	1 3-8	6	1.2668	.1082
	38		.0171	1 1-2	6	1.3918	.1082
	36		.0180	1 5-8	5 1-2	1.507	.1180
	34		.0191	1 3-4	5	1.6201	.1299
	32		.0203	1 7-8	5	1.7451	.1299
	30		.0217	2	4 1-2	1.8557	.1443
	28		.0232	2 1-2	4	2.3376	.1624
	26		.0250	3	3 1-2	2.8145	.1855
	24		.0271	3 1-2	3 1-4	3.3002	.1998
	22		.0295	4	3	3.7835	.2165

As there is no standard of diameter for the finer pitches, the columns for Diameter and Caliper Reading, or Pitch Diameter, are left blank. The column on the right gives the number to be subtracted from the diameter to obtain the caliper reading, or pitch diameter.

# Table

FOR USE IN CONNECTION WITH

## Brown & Sharpe Mfg. Co.'s Screw Thread Micrometer Caliper.

READING OF CALIPER, OR PITCH DIAMETER.

$$\text{For Whitworth Threads} = D - \frac{.640}{N}$$

### WHITWORTH STANDARD THREADS.

Diam.	Threads per Inch.	Caliper Reading or Pitch Diam.		Diam.	Threads per Inch.	Caliper Reading or Pitch Diam.	
D	N	$D - \frac{.640}{N}$	$\frac{.640}{N}$	D	N	$D - \frac{.640}{N}$	$\frac{.640}{N}$
	48		.0133	1-4"	20	.2180	.0320
	46		.0139	5-16	18	.2769	.0355
	44		.0146	3-8	16	.3350	.0400
	42		.0152	7-16	14	.3918	.0457
	40		.0160	1-2	12	.4467	.0533
	38		.0168	9-16	12	.5092	.0533
	36		.0178	5-8	11	.5668	.0582
	34		.0188	11-16	11	.6293	.0582
	32		.0200	3-4	10	.6860	.0640
	30		.0213	13-16	10	.7485	.0640
	28		.0229	7-8	9	.8039	.0711
	26		.0246	15-16	9	.8664	.0711
	24		.0267	1	8	.9200	.0800
	22		.0291	1 1-8	7	1.0336	.0914
				1 1-4	7	1.1586	.0914
				1 3-8	6	1.2684	.1066
				1 1-2	6	1.3934	.1066
				1 5-8	5	1.4970	.1280
				1 3-4	5	1.6220	.1280
				1 7-8	4 1-2	1.7328	.1422
				2	4 1-2	1.8578	.1422
				2 1-8	4 1-2	1.9828	.1422

# Tables

FOR USE IN CONNECTION WITH

## Brown & Sharpe Mfg. Co.'s Screw Thread Micrometer Caliper.

READING OF CALIPER, OR PITCH DIAMETER.

$$\text{For A. S. M. E. Std.} = D - \frac{.6495}{N}$$

Same Form of Thread as the United States Standard.

No.	Basic and Max. Outside Diam. D	Threads per Inch. N	Caliper Reading or Maximum Pitch Diameter. D — $\frac{.6495}{N}$	$\frac{.6495}{N}$	No.	Basic and Max. Outside Diam. D	Threads per Inch. N	Caliper Reading or Maximum Pitch Diameter. D — $\frac{.6495}{N}$	$\frac{.6495}{N}$
0	.060	80	.0519	.0081	12	.216	28	.1928	.0232
1	.073	72	.064	.0090	14	.242	24	.2149	.0271
2	.086	64	.0759	.0101	16	.268	22	.2385	.0295
3	.099	56	.0874	.0116	18	.294	20	.2615	.0325
4	.112	48	.0985	.0135	20	.320	20	.2875	.0325
5	.125	44	.1102	.0148	22	.346	18	.3099	.0361
6	.138	40	.1218	.0162	24	.372	16	.3314	.0406
7	.151	36	.1330	.0180	26	.398	16	.3574	.0406
8	.164	36	.146	.0180	28	.424	14	.3776	.0464
9	.177	32	.1567	.0203	30	.450	14	.4036	.0464
10	.190	30	.1684	.0217					

READING OF CALIPER, OR PITCH DIAMETER.

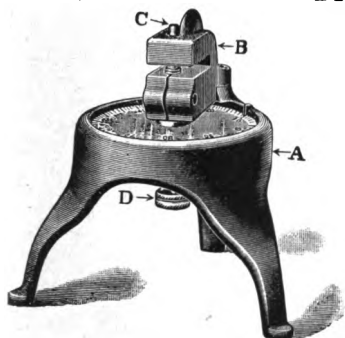
$$\text{For S. A. E. Threads} = D - \frac{.6495}{N}$$

Same Form of Thread as the United States Standard.

Diameter. D	Threads per Inch. N	Caliper Reading or Pitch Diam. D — $\frac{.6495}{N}$	$\frac{.6495}{N}$	Diameter D	Threads per Inch. N	Caliper Reading or Pitch Diam. D — $\frac{.6495}{N}$	$\frac{.6495}{N}$
1-4"	28	.2268	.0232	3-4"	16	.7094	.0406
5-16	24	.2854	.0271	7-8	14	.8286	.0464
3-8	24	.3479	.0271	1	14	.9536	.0464
7-16	20	.4050	.0324	1 1-8	12	1.0709	.0541
1-2	20	.4675	.0324	1 1-4	12	1.1959	.0541
9-16	18	.5265	.0360	1 3-8	12	1.3209	.0541
5-8	18	.5890	.0360	1 1-2	12	1.4459	.0541
11-16	16	.6469	.0406				

## Sheet Metal Micrometer No. 220.

Price, \$10 00.



This Micrometer measures to 1-4" by 220 thousandths of an inch. It is a convenient tool for Jewelers, Silversmiths, Sheet Metal Rollers and Workers, Rubber and Paper 221 Manufacturers, Type Founders, etc.

The frame A supports the measuring mechanism. The arm B holds the measuring screw D and the adjusting screw C. The knurled thumb screw D operates the measuring screw and the movable dial.

The movable dial is of German silver and the graduations are read by means of the pointer shown at the right of arm B.

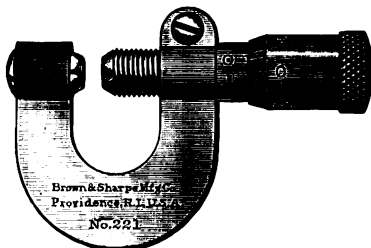
Provision is made for compensation for wear.

## Micrometer Caliper No. 221.

(POCKET SHEET METAL GAUGE.)

Range, 0 to 3-10".

Price, \$4 50. With Ratchet Stop, \$5 00. Morocco Case, \$0 65.



This Caliper is shown full size and measures all sizes less than three-tenths of an inch by thousandths of an inch.

# Micrometer Caliper No. 222.

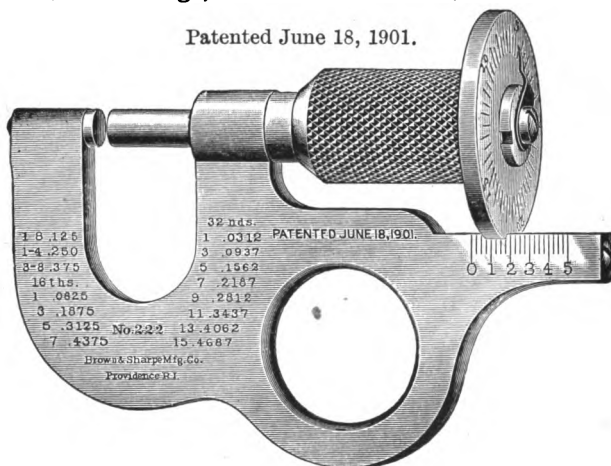
ENGLISH OR METRIC MEASURE.

Sheet Metal Gauge.

222

Range, 0 to 1-2" or 0 to 13 m/m.

Patented June 18, 1901.



Price, \$6 00.

Morocco Case, \$0 65.

This Micrometer Caliper, shown full size, is especially convenient for sheet metal workers and handlers.

By placing the middle finger of the right hand through the ring, the Caliper is held at right angles to the sheet to be measured and readings made while in this position. The thimble is operated by the forefinger and thumb of the same hand.

The Caliper measures all sizes less than one-half of an inch by one-half thousandths of an inch and one-quarter thousandths are readily estimated.

To facilitate the reading of the Caliper while held in position, the one-half thousandths readings are taken from the dial at the top of the spindle, the readings being indicated by the pointer; and the twenty-five thousandths readings, or those corresponding to the readings on the barrel of an ordinary Micrometer Caliper, are taken from the scale at the top of the frame.

The decimal equivalents stamped on the frame are convenient and render possible the immediate expression of readings in 8ths, 16ths, 32ds and 64ths of an inch.

**Metric Measure.** This Caliper is also made to measure all sizes less than thirteen millimetres by hundredths of a millimetre.



## Micrometer Caliper No. 223.

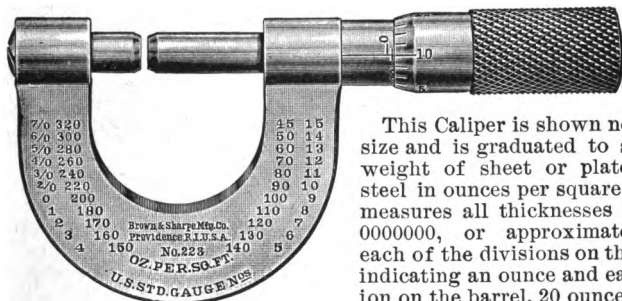
**U. S. Standard Gauge for Sheet and Plate Iron and Steel.**

**Range, 0 to 320 oz. per square foot.**

**Price, \$5 50.**

**With Ratchet Stop, \$6 00.**

**Morocco Case, \$0 65.**



223

225

This Caliper is shown nearly full size and is graduated to show the weight of sheet or plate iron or steel in ounces per square foot. It measures all thicknesses less than 0.000000, or approximately 1-2", each of the divisions on the thimble indicating an ounce and each division on the barrel, 20 ounces.

By the table of equivalents stamped on the frame of the Caliper, the gauge number of the sheet or plate can be quickly determined when its weight per square foot has been ascertained.

## Micrometer Caliper No. 225.

**FOR MEASURING THE THICKNESS OF TUBING.**

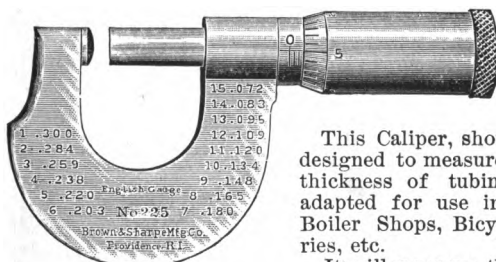
**ENGLISH OR METRIC MEASURE.**

**Range, 0 to 1-2" or 0 to 13 m/m.**

**Price, \$5 00.**

**With Ratchet Stop, \$5 50.**

**Morocco Case, \$0 65.**



This Caliper, shown full size, is designed to measure accurately the thickness of tubing and is well adapted for use in Tube Works, Boiler Shops, Bicycle Manufacturers, etc.

It will measure the thickness of tubing from 5-16" inside diameter upwards by thousandths of an inch. The anvil or fixed measuring point is rounded on the end so that it touches at only one point on the inside of the tube and, the end of the movable spindle being flat, touches at only one point on the outside, thus giving the exact thickness of the tube.

The table of equivalents stamped on the frame determines the gauge number of the tubing in accordance with the English Standard.

**Metric Measure.** This Caliper is also made to measure thickness of tubing from 8 millimetres inside diameter upwards by hundredths of a millimetre, and when so made the table of equivalents is omitted from the frame.

## Micrometer Caliper No. 227.

FOR ELECTRICIANS.

Range, 0 to 1-2".

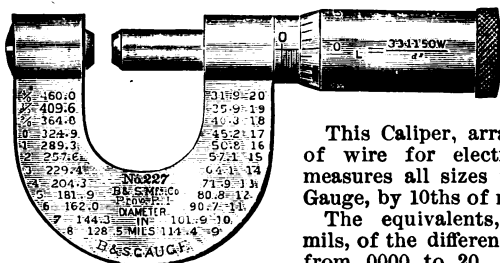
Price, \$6 00.

With Ratchet Stop, \$6 50.

Morocco Case, \$0 65.

227

228



This Caliper, arranged for users of wire for electrical purposes, measures all sizes to 0000, B & S Gauge, by 10ths of mils.

The equivalents, expressed in mils, of the different sizes of wire from 0000 to 20, B & S Gauge,

are stamped on one side of the frame and the circular mils of the same size on the other.

Three formulas are stamped on the thimble: one for the weight, length in feet and diameter being known; one for length in feet, weight and diameter being known; and one for resistance of commercial copper wire, in ohms per hundred feet at 75° F., length and diameter being known.

## Micrometer Caliper No. 228.

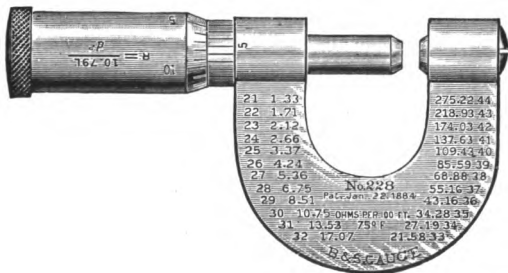
FOR ELECTRICIANS.

Range, 0 to 1-2".

Price, \$6 00.

With Ratchet Stop, \$6 50.

Morocco Case, \$0 65.



This Caliper differs from Micrometer Caliper No. 227, only in that the equivalents stamped on one side of the frame are for wire from 21 to 44, B & S Gauge, and the resistance of commercial copper wire, in ohms per hundred feet at 75° F., of the same sizes on the other.

## Paper Gauge Micrometer Caliper, No. 230.

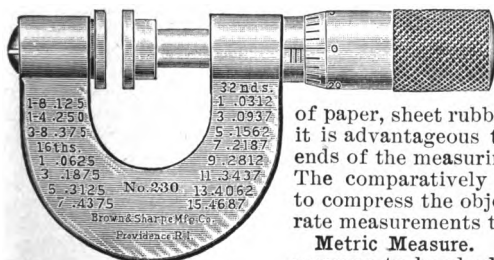
ENGLISH OR METRIC MEASURE.

Range, 0 to 3-8" or 0 to 9 m/m.

Price, \$6 00.

With Ratchet Stop, \$6 50.

Morocco Case, \$0 65.



This Caliper measures all sizes less than three-eighths of an inch by thousandths of an inch.

In measuring the thickness of paper, sheet rubber or other yielding substances, it is advantageous to use discs or washers on the ends of the measuring spindle and adjusting screw. The comparatively large sizes have less tendency to compress the objects measured and enable accurate measurements to be quickly obtained.

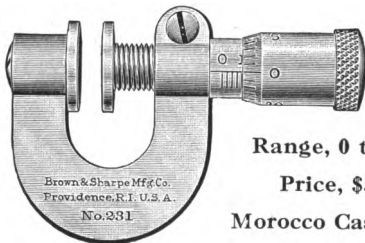
**Metric Measure.** This Caliper is also made to measure to hundredths of a millimetre. When so

made, the table of decimal equivalents is omitted.

## Paper Gauge Micrometer Caliper, No. 231.

ENGLISH MEASURE.

This Caliper, shown full size, is similar in design to Micrometer Caliper No. 230. It measures all sizes less than one-quarter inch by thousandths of an inch. It will be found well adapted for carrying in the pocket.



Range, 0 to 1-4".

Price, \$5 50.

Morocco Case, \$0 65.

## Paper Gauge Micrometer Caliper, No. 232.

ENGLISH OR METRIC MEASURE.

Price, \$8 00.

With Ratchet Stop, \$8 50.

Morocco Case, \$1 50.

This Micrometer Caliper measures all sizes less than three-eighths of an inch by thousandths of an inch, and is similar in design to Micrometer Caliper No. 230.

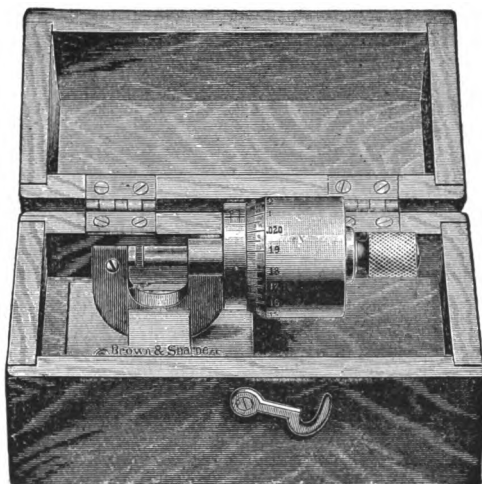
The measuring spindle and adjusting screw are furnished with discs like Calipers shown above.

## Micrometer Caliper No. 233.

ENGLISH OR METRIC MEASURE.

233

Range, 0 to 1-2" or 0 to 13 m/m.



Price, in Case, \$17 00.

This Caliper is shown half size and measures all sizes less than one-half inch by ten-thousandths of an inch. The measurements can be read directly from the barrel; the screw has fifty threads and the barrel is divided into two hundred equal parts.

This Caliper is found of service to wire drawers, watchmakers and others who desire fine measurements and whose work is of such a class that a Micrometer Caliper can be used when placed on a bench.

**Metric Measure.** This Caliper is also made to measure all sizes less than thirteen millimetres by one two-hundredths of a millimetre.

# Micrometer Caliper, No. 235.

## Rolling Mill Gauge.

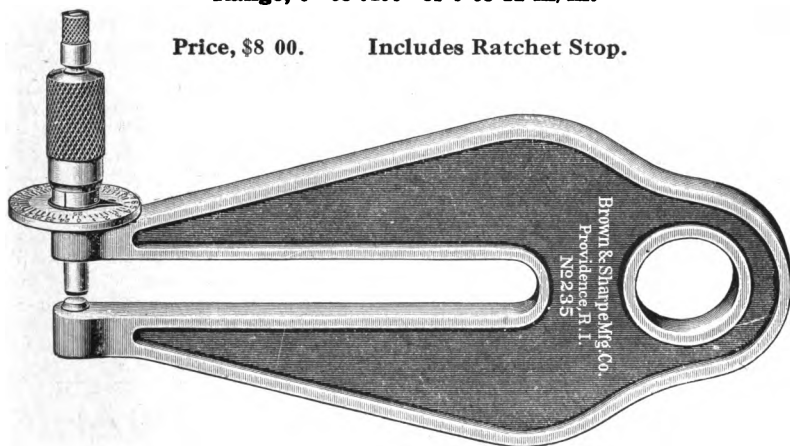
ENGLISH OR METRIC MEASURE.

235

Range, 0" to .400" or 0 to 12 m/m.

Price, \$8 00.

Includes Ratchet Stop.



This Micrometer Caliper, shown about one-half size, is found well adapted to sheet metal workers' use.

The gauge screw is encased and protected from dirt and injury. Means of adjustment are provided to compensate for wear.

The opening in the frame is about 4 1-2" deep, a feature much appreciated, as it enables sheet metal to be more accurately measured than would be possible with an ordinary Micrometer.

The Caliper differs slightly in design from the regular caliper in the method of obtaining readings. The thousandths readings, usually taken from the sleeve, being taken from a dial graduated into 25 equal parts; and by means of the pointer, readings can be easily made to one-half thousandths. For convenience in reading, the hub is graduated on opposite sides.

Each Caliper is provided with a Ratchet Stop that enables measurements to be quickly and accurately made.

## Micrometer Caliper No. 237.

**Rolling Mill Gauge.**

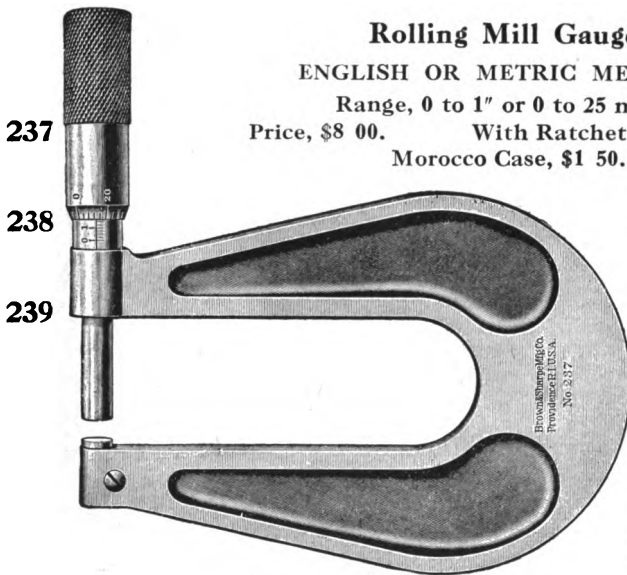
**ENGLISH OR METRIC MEASURE.**

Range, 0 to 1" or 0 to 25 m/m.

Price, \$8 00.

With Ratchet Stop, \$8 50.

Morocco Case, \$1 50.



This Caliper is designed for sheet metal workers' use, although it is also adapted for a wide range of other uses requiring a caliper of unusual depth. The opening in the frame is about 3" deep, a feature much appreciated, as it enables sheet metal to be more accurately measured than would be possible with an ordinary Micrometer.

## Micrometer Caliper No. 238.

**Rolling Mill Gauge.**

**ENGLISH OR METRIC MEASURE.**

Range, 0 to 1-2" or 0 to 13 m/m.

Price, \$6 75.

With Ratchet Stop, \$7 25.

This Caliper differs from Micrometer Caliper No. 237, in having a smaller range. Opening in frame about 2" deep.

## Micrometer Caliper No. 239.

**Rolling Mill Gauge.**

**ENGLISH OR METRIC MEASURE.**

Range, 0 to 1" or 0 to 25 m/m.

With Ratchet Stop, \$9 50.

This Caliper differs from Micrometer Caliper No. 237, in having a greater measuring capacity. Opening in frame about 6" deep. It is regularly furnished with Ratchet Stop.

# Hub Micrometer Caliper, No. 241.

ENGLISH OR METRIC MEASURE.

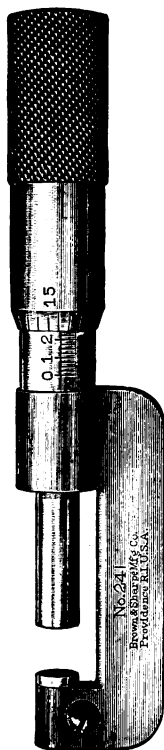
241

Range, 0 to 1" or 0 to 25 m/m.

Price, \$6 00.

With Ratchet Stop, \$6 50.

Morocco Case, \$0 65.



This Caliper is adapted for use in determining the thickness at the centre of saws, the exact hub lengths of cutters, and similar measurements on other articles.

For this reason the frame is made so that it will pass through a 3-4" hole.

This Caliper measures all sizes less than one inch by thousandths of an inch.

**Metric Measure.** This Caliper is also made to measure all sizes less than twenty-five millimetres by hundredths of a millimetre.

## Bench Micrometer Caliper, No. 243.

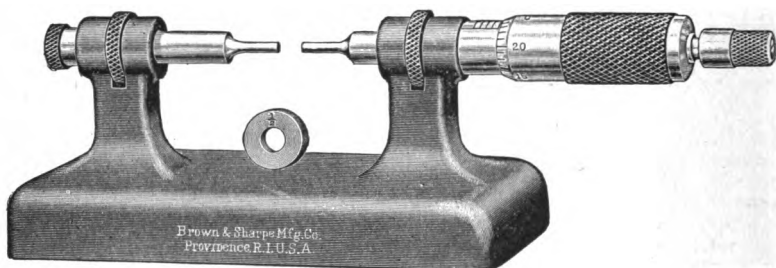
ENGLISH OR METRIC MEASURE.

243

Range, 0 to 1" or 0 to 25 m/m.

Price, \$8 00.

Patented December 30, 1902.



This Caliper is designed with reference to the wants of Watchmakers, Inspectors, Manufacturing Jewelers, etc., who frequently require a Micrometer Caliper for quick, accurate measurements on work at the bench. For this purpose it is made with a heavy base insuring rigidity and preventing it from being easily upset.

The measuring points are 5-64" (.078") diameter.

A Standard Gauge to be used in adjusting this caliper is sent with same.

This Caliper is provided with a Ratchet Stop and Clamp Rings that clamp the spindle and anvil and preserve the setting.

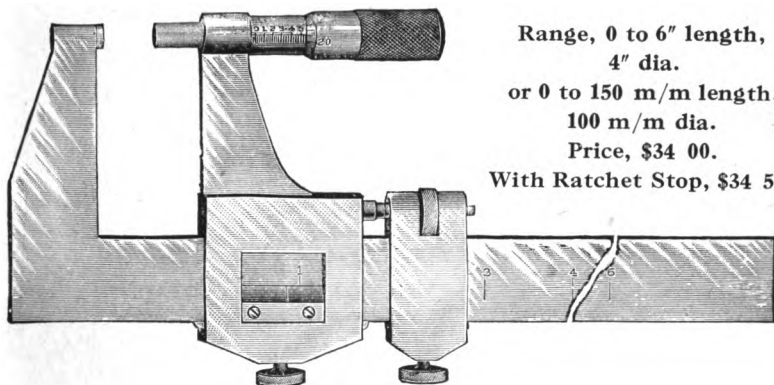
It measures all sizes less than one inch by thousandths of an inch.

**Metric Measure.** This Caliper is also made to measure all sizes less than twenty-five millimetres by hundredths of a millimetre.



## Micrometer Caliper No. 245.

ENGLISH OR METRIC MEASURE.



Range, 0 to 6" length,  
4" dia.

or 0 to 150 m/m length, **245**  
100 m/m dia.

Price, \$34 00.

With Ratchet Stop, \$34 50. **246**

**248**

This Caliper measures all sizes to six inches in length and four inches in diameter, by thousandths of an inch.

The outer end of the frame is the same size as the measuring spindle and the edges of the measuring surfaces are left square.

The slide can be set accurately by means of the graduated lines on the bar.

All parts of inches are obtained by means of a micrometer screw.

**Metric Measure.** This Caliper is also made to measure all sizes less than 150 millimetres in length and 100 millimetres in diameter by hundredths of a m/m.

## Micrometer Caliper No. 246.

ENGLISH OR METRIC MEASURE.

Range 0 to 12" length, 6" dia. or 0 to 300 m/m length, 150 m/m dia.

Price, \$39 00. With Ratchet Stop, \$39 50.

This Caliper, similar in design to Micrometer Caliper No. 245, is made to measure all sizes to twelve inches in length and six inches in diameter by thousandths of an inch.

**Metric Measure.** This Caliper is also made to measure all sizes less than 300 millimetres in length and 150 millimetres in diameter by hundredths of a m/m.

## Micrometer Caliper No. 248.

ENGLISH OR METRIC MEASURE.

Range, 0 to 24" length, 6" dia. or 0 to 600 m/m length, 150 m/m dia.

Price, \$50 00. With Ratchet Stop, \$50 50.

This Caliper, similar in design to Micrometer Caliper No. 245, is made to measure all sizes to twenty-four inches in length and six inches in diameter by thousandths of an inch.

**Metric Measure.** This Caliper is also made to measure all sizes less than 600 millimetres in length and 150 millimetres in diameter by hundredths of a m/m.

# Depth of Gear Tooth Micrometer, No. 249.

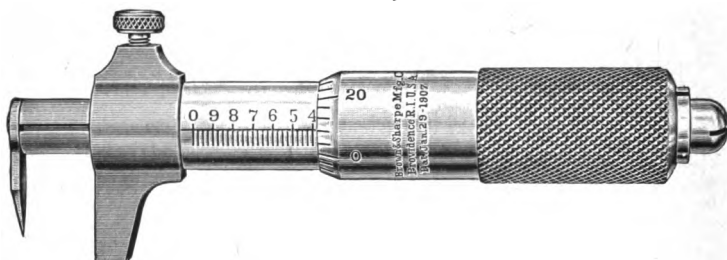
**249**                      **ENGLISH OR METRIC MEASURE.**

**Range, 0 to 1" or 0 to 25 m/m.**

**Price, \$5 00.**

**Morocco Case, \$0 65.**

**Patented January 29, 1907**



This Micrometer is designed for scribing a line on gear blanks to accurately indicate the extreme depth to cut the teeth. For this purpose it is a particularly economical tool in that it does away with the necessity of keeping a large number of separate gauges for the different pitches.

Tool Makers will also find it handy as a scratch gauge in scribing lines and measuring spacing within its range.

The scriber point is hardened, and a Clamp Screw is provided by means of which a setting may be preserved.

This Micrometer is made to measure all sizes less than one inch by thousandths of an inch.

**Metric Measure.** This Micrometer is also made to measure sizes from 0 to 25 m/m by hundredths of a millimetre.

**Extra Scriber Points. Price, \$0 25.**

## Inside Micrometer Caliper, No. 250.

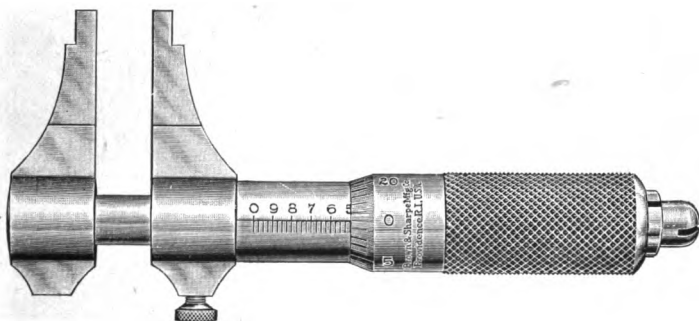
Patented January 29, 1907.

ENGLISH OR METRIC MEASURE.

Range, .200" to 1" or 5 m/m to 25 m/m.

Price, \$5 50. Morocco Case, \$0 65.

250



This Caliper is intended to meet the demand for a tool adapted to measure small internal dimensions. It is graduated to read to thousandths of an inch.

The measuring screw is entirely enclosed, thus protecting it from dirt and injury.

The measuring surfaces are hardened and ground to a radius to insure accurate measurements and prevent cramping when measuring parallel surfaces.

The Caliper is provided with a Clamp Screw to preserve the setting.

**Metric Measure.** This Caliper is also made to measure sizes from 5 m/m to 25 m/m by hundredths of a millimetre.

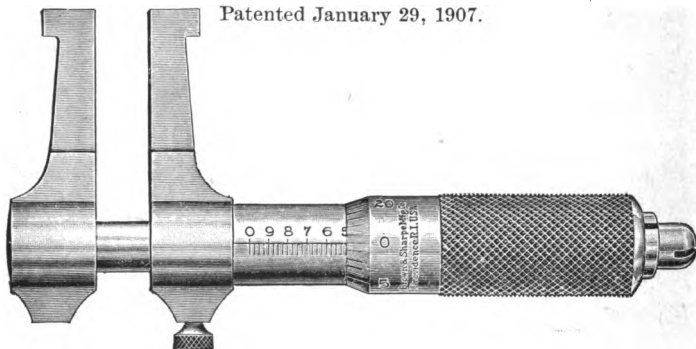
## Inside Micrometer Caliper, No. 252.

ENGLISH OR METRIC MEASURE.

Range, 1-2" to 1 1-2" or 12 m/m to 37 m/m.

Price, \$6 50. Morocco Case, \$0 65.

Patented January 29, 1907.



This Caliper differs from the No. 250, shown on the preceding page, only in the shape of the jaws. This is a new feature, and permits inside measurements over a flange or shoulder which could not be made with the other style of jaws.

This Caliper is provided with a Clamp Screw to preserve the setting.

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## Inside Micrometer Caliper, No. 254.

Patented January 29, 1907.

ENGLISH OR METRIC MEASURE.

Range, 1" to 2" or 25 m/m to 50 m/m.

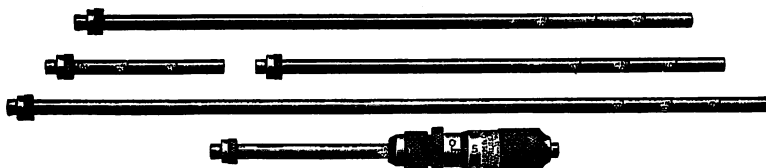
Price, \$6 50. Morocco Case, \$0 65.

This Caliper is of the same design as the No. 252 shown above. It is provided with a Clamp Screw to preserve the setting.

**Metric Measure.** The above Calipers are also made to read to hundredths of a millimetre.

# Inside Micrometers, Nos. 260 and 261.

ENGLISH OR METRIC MEASURE.



260

261

This Micrometer consists of a holder with a micrometer screw and thimble graduated to read to .001". The extension rods are graduated by a series of angular grooves of a form and depth that allow the clamping fingers to spring in and the adjustments quickly and positively made.

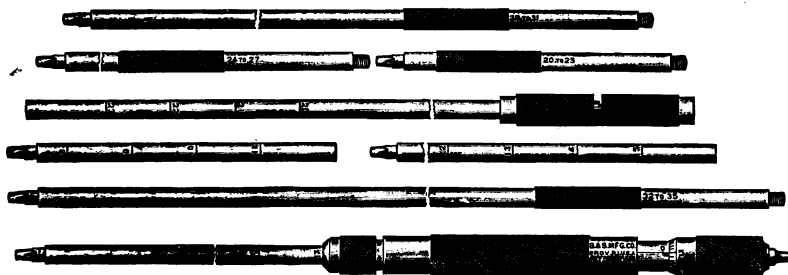
**Metric Measure.** This Micrometer is also made to read to hundredths of a millimetre.

262

No.	No. of Rods.	Range.	Price without Case	Price with Case.
260	5	2" to 9 1-2"	\$4 50	\$5 25
	6	50 m/m to 230 m/m	4 50	5 25
261	7	2" to 12 1-2"	5 50	6 50
	8	50 m/m to 290 m/m	5 50	6 50

# Inside Micrometer, No. 262.

ENGLISH OR METRIC MEASURE.



These Gauges consist of a holder with a micrometer screw and thimble graduated to .001". The extension rods are graduated by a series of angular grooves of a form and depth that allow the clamping fingers to spring in and the adjustments quickly and positively made.

**Metric Measure.** These Gauges are also made to read to hundredths of a millimetre.

No.	No. of Rods.	Range.	Price without Case.	Price with Case.
262	8	8" to 36"	\$7 50	\$9 00
	8	200 m/m to 900 m/m	7 50	9 00

## Tubular Inside Micrometers.



270

The Tubular Inside Micrometers are distinctively new in design, being made of tubing, which renders them very light and convenient to handle, especially those of the longer lengths.

These Micrometers are designed for measuring the inside diameters of rings, cylinders, etc., setting calipers, comparing gauges and work of a similar nature. They are fitted at one end with a micrometer head having a 1-2" or 1" movement. The measuring points are hardened; and the faces are ground on a radius, thus adapting them especially for measuring parallel or curved surfaces.

Provision is made for adjustment to compensate for wear on the measuring surfaces by means of a knurled adjusting nut. Fibre grips are also provided to guard against inaccuracies due to the heat of the hand. The small sizes have only one grip, while the larger sizes have two.

Each Micrometer is fitted with a **Clamp Screw**, which clamps the spindle and preserves the setting.

These Micrometers as listed on the following page can be furnished in both a complete English or a complete Metric Set.

## Tubular Inside Micrometers, No. 270.

### ENGLISH MEASURE.

No.	Range.	Price.	Range.	Price.	Range.	Price.
270	2" to 2½"	\$3 50 each.	12" to 13"	\$4 50 each.	26" to 27"	\$5 50 each.
	2½" to 3		13 to 14		27 to 28	
	3 to 3½		14 to 15		28 to 29	
	3½ to 4		15 to 16		29 to 30	
	4 to 4½		16 to 17		30 to 31	
	4½ to 5		17 to 18		31 to 32	
	5 to 6	\$4 00 each.	18 to 19	\$5 00 each.	32 to 33	\$6 00 each.
	6 to 7		19 to 20		33 to 34	
	7 to 8		20 to 21		34 to 35	
	8 to 9		21 to 22		35 to 36	
	9 to 10		22 to 23		36 to 37	
	10 to 11		23 to 24		37 to 38	
	11 to 12		24 to 25	\$5 50 each.	38 to 39	\$6 50 each
			25 to 26		39 to 40	

# Tubular Inside Micrometers, No. 272.

## METRIC MEASURE.

No.	Range in Millimetres.	Price.	Range in Millimetres.	Price.	Range in Millimetres.	Price.	
272	50 to 63	\$3 50 each.	300 to 325	\$4 50 each.	650 to 675	\$5 50 each.	272
	63 to 75		325 to 350		675 to 700		
	75 to 88		350 to 375		700 to 725		
	88 to 100		375 to 400		725 to 750		
	100 to 113	\$4 00 each.	400 to 425	\$5 00 each.	750 to 775	\$6 00 each.	273
	113 to 125		425 to 450		775 to 800		
	125 to 150		450 to 475		800 to 825		
	150 to 175		475 to 500		825 to 850		
	175 to 200		500 to 525		850 to 875		274
	200 to 225		525 to 550		875 to 900		
	225 to 250		550 to 575		900 to 925		
	250 to 275		575 to 600		925 to 950		
	275 to 300		600 to 625		950 to 975		285
			625 to 650		975 to 1000		

# Tubular Inside Micrometer Set, No. 273.

## ENGLISH OR METRIC MEASURE.

7 Micrometers, Range 2" to 6", or 50 m/m to 150 m/m.

Price, \$25 00.

Suitable wooden case furnished with this set.

# Tubular Inside Micrometer Set, No. 274.

## ENGLISH OR METRIC MEASURE.

13 Micrometers, Range 2" to 12", or 50 m/m to 300 m/m.

Price, \$49 00.

Suitable wooden case furnished with this set.

# Tubular Inside Micrometer Set, No. 285.

## ENGLISH OR METRIC MEASURE.

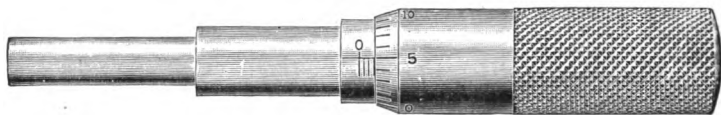
41 Micrometers, Range 2" to 40", or 50 m/m to 1000 m/m.

Price, \$197 50.

This set includes all of the English or Metric Tubular Inside Micrometers listed on pages 54 and 55.

A suitable wooden case is furnished with this set.

## Micrometer Heads.



290

ENGLISH OR METRIC MEASURE.

### 291 1-2 Inch Micrometer Head, No. 290.

ENGLISH OR METRIC MEASURE.

294 Graduated to read to thousandths of an inch or hundredths of a millimetre.

Price, \$3 00. With or Without Ratchet Stop.

The 1-2" Micrometer Heads differ from the 1" in the size and range.

Length from lower end of barrel to shoulder, 3-8"; diameter of barrel, 3-8"

295

### 1-2 Inch Micrometer Head, No. 291.

ENGLISH MEASURE.

Graduated to read to ten-thousandths of an inch.

Price, \$4 00. With or Without Ratchet Stop.

This Tool differs from Micrometer Head No. 290, only in being graduated to read to ten-thousandths as well as thousandths of an inch.

### 1 Inch Micrometer Head, No. 294.

ENGLISH OR METRIC MEASURE.

Graduated to read to thousandths of an inch or hundredths of a millimetre.

Price, \$3 50. With or Without Ratchet Stop.

These Micrometer Heads are readily attached to machines or tools, when fine adjustments are required.

Length from lower end of barrel to shoulder, 3-4"; diameter, 3-8".

### 1 Inch Micrometer Head, No. 295.

ENGLISH MEASURE.

Graduated to read to ten-thousandths of an inch.

Price, \$4 50. With or Without Ratchet Stop.

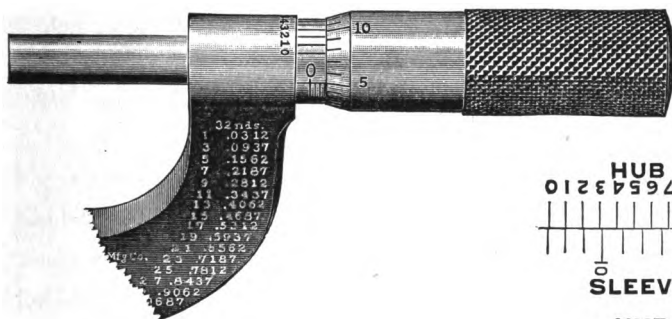
This tool differs from Micrometer Head No. 294, only in being graduated to read to ten-thousandths as well as thousandths of an inch.

The 1" Micrometer Heads can be furnished with Clamp Screws when so ordered.



## Micrometer Calipers.

### EXPLANATION AND METHOD OF READING THE CALIPERS WITH TEN-THOUSANDTHS GRADUATIONS.



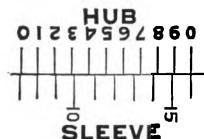
The readings in ten-thousandths of an inch are obtained by means of a Vernier or series of divisions on the hub of the Caliper, as shown in cut. These divisions are ten in number, occupy the same space as nine divisions on the sleeve and for convenience in reading are figured 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

Accordingly, when a line on the sleeve coincides with the first line of the Vernier, the next two lines to the right differ from each other one-tenth of the length of a division on the sleeve; the next lines differ by two-tenths, etc. See upper cut of graduations on hub and sleeve.

When the Caliper is opened, the sleeve is turned to the left and when a division passes a fixed point on the hub, it shows the Caliper has been opened one-thousandth of an inch. Hence, when the sleeve is turned so that a line on the sleeve coincides with the second line (end of the first division) of the Vernier, the sleeve has moved one-tenth of the length of one of its divisions and the Caliper opened one-tenth of one thousandth, or one ten-thousandth of an inch. When a line on the sleeve coincides with the third line (end of second division) of the Vernier, the Caliper has been opened two ten-thousandths of an inch, etc. See lower cut of graduations, where a line on the sleeve coincides with the fourth line (end of third division of the Vernier) and the reading is three ten-thousandths of an inch.

**To Read the Caliper,** note the thousandths as usual, then the number of divisions on the Vernier, commencing at 0, until a line is reached with which a line on the sleeve is coincident. If the second line, figured 1, add one ten-thousandth; if the third, figured 2, two ten-thousandths, etc.

Calipers graduated to ten-thousandths should not be used commonly where fine measurements are not required, as a wear, which would be of comparatively slight consequence in a Caliper that reads only to thousandths, is perceptible and important in an instrument of this class.



## Standards of Length.

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The Standard Yard was first legalized in England, in 1824; this Standard, however, was destroyed in 1834. The Standard Imperial Yard, "Bronze No. 1," was then prepared and legalized in 1855. Forty copies were made and one of these, "Bronze No. 11," was presented to the United States by the British Government in 1856. At the same time another copy, known as "Low Moor Iron No. 57," was sent. These were accurately compared, before being sent, with the Standard Imperial Yard and the record of the variations sent with them.

The use of the Metre as a Standard in this country was legalized in 1866 and prototypes of the original Metre Bar were prepared in 1899, one of these, which was sent to Washington now being used as the basis of "Metric Measurements" in this country.

We prepared Standards for use in our own shops and after their completion, they were compared by the Government officials with the Standards in Washington.

The mean errors were found to be: for the Yard .00002", and for the Metre .000005 M., both being too long.

These Standards have been subdivided with the greatest care and accuracy and our Rules are as nearly exact copies as expert mechanical skill, aided by machines especially designed for the purpose, can make them.

## Graduations.

Our Rules, both Standard and Tempered, are divided in Parts of an Inch, as follows:

No. 1 Graduation.	No. 2 Graduation.	No. 4 Graduation.
1st corner, 10, 20, 50, 100	8	8
2d corner, 12, 24, 48	10, 20, 50, 100	16
3d corner, 14, 28	12, 24, 48	32
4th corner, 16, 32, 64	16, 32, 64	64

### No. 5 Graduation.

1st corner, 11, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25
2d corner, 16, 32, 64
3d corner, 26, 27, 28, 29, 30, 31, 33, 34, 35, 36, 37, 38
4th corner, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 100

No. 6 Graduation.	No. 7 Graduation.	*No. 9 Graduation.
1st corner, 32	16	10, 20
2d corner, 48	32	16
3d corner, 50	64	32, 64
4th corner, 64	100	50, 100

No. 10 Graduation.	No. 11 Graduation.	No. 12 Graduation.
1st corner, 32	64	50
2d corner, 64	100	100

No. 13 Graduation.	No. 14 Graduation.	No. 16 Graduation.
1st corner, 8	8	32
2d corner, 16	32	64
3d corner, ..	..	50
4th corner, ..	..	100

\* Placed on 2 inch Rules only.

**End**



**Graduations.**

All Tempered Steel Rules 2" to 12" in length with No. 4 Graduations are furnished with Patent End Graduations, reading to 32ds of an inch on two ends of one side. This feature will be found advantageous in measuring the depth and width of grooves, countersinks and recesses of various kinds. Prices are the same as given in the list on pages 60 and 67.

## Tempered Steel Rules, No. 300.



These Rules are about 1-20" thick.

300

301

302

No.	Length.	Approximate Width.	Number of Graduations.	Price.
300	1"	29-64"	4 or 7	\$0 20
	2	1-2	4, 7 or 9	30
	3	35-64	1, 2, 4, 6 or 7	40
	4	19-32	1, 2, 4, 6 or 7	50
	6	11-16	1, 2, 4, 6 or 7	65
	9	53-64	1, 2, 4, 6 or 7	1 00
	12	31-32	1, 2, 4, 6 or 7	1 25
	18	1	1, 2, 4, 6 or 7	2 00
	24	1	1, 2, 4, 6 or 7	2 50
	36	1	1, 2, 4, 6 or 7	5 00

## Tempered Steel Rules, No. 301.

### METRIC MEASURE.

First corner graduated to 1-2 m/m, remaining three corners to 1 m/m.

No.	Length.	Price.
301	10 Centimetres,	\$0 50
	15 Centimetres,	65
	20 Centimetres,	85
	30 Centimetres,	1 25
	50 Centimetres,	2 00

## Tempered Steel Rules, No. 302.

### ENGLISH AND METRIC MEASURE.

First corner graduated, 2" to 1-64 of an inch, the remainder to 1-16 of an inch; second corner to 1 m/m; third corner, 2" to 1-100 of an inch, the remainder to 1-50 of an inch; fourth corner to 1-2 m/m.

No.	Length.	Price.
302	*10 Centimetres,	\$0 50
	*15 Centimetres,	65
	20 Centimetres,	85
	30 Centimetres,	1 25
	50 Centimetres,	2 00

\* First corner graduated to 1-64 of an inch, second corner to 1 m/m, third corner to 1-100 of an inch, fourth corner to 1-2 m/m.

## Narrow Tempered Steel Rules, No. 303.



These Rules are about 1-20" thick and about 7-32" wide. They are graduated on one corner of each side only. 303

No.	Length.	No. of Graduations.	Price.	
303	4"	10, 11 or 12	\$0 50	304
	6	10, 11 or 12	65	
	9	10, 11 or 12	1 00	
	12	10, 11 or 12	1 25	

## Narrow Tempered Steel Rules, No. 304.

### METRIC MEASURE.

Graduated on one corner of each side only. First corner graduated to 1-2 m/m, second corner to 1 m/m.

No.	Length.	Price.
304	10 Centimetres.	\$0 50
	15 Centimetres.	65
	20 Centimetres.	85
	30 Centimetres.	1 25

## Narrow Tempered Steel Rules, No. 305.

### ENGLISH AND METRIC MEASURE.

Graduated on one corner of each side only. First corner graduated to 64ths, second corner to 1-2 m/m.

No.	Length.	Price.
305	10 Centimetres.	\$0 50
	15 Centimetres.	65
	20 Centimetres.	85
	30 Centimetres.	1 25

## Flexible Steel Rules, No. 306.



Graduated on one side only.

No.	Length.	Approximate Width.	Number of Graduations.	Price.
306	4"	1-2"	10, 11, 12, 13 or 14	\$0 50
	6	1-2	10, 11, 12, 13 or 14	65
	9	1-2	10, 11, 12, 13 or 14	1 00
	12	1-2	10, 11, 12, 13 or 14	1 25
	18	3-4	10, 11, 12, 13 or 14	2 00
	24	3-4	10, 11, 12, 13 or 14	2 50
308	36	3-4	10, 11, 12, 13 or 14	5 00

## Flexible Steel Rules, No. 307.

METRIC MEASURE.

Graduated on one side only. First corner to 1-2 m/m, second corner to 1 m/m.

No.	Length.	Price.
307	10 Centimetres.	\$0 50
	15 Centimetres.	65
	20 Centimetres.	85
	30 Centimetres.	1 25
	50 Centimetres.	2 00

## Flexible Steel Rules, No. 308.

ENGLISH AND METRIC MEASURE.

Graduated on one side only. First corner to 64ths, second corner to 1-2 m/m.

No.	Length.	Price.
308	10 Centimetres.	\$0 50
	15 Centimetres.	65
	20 Centimetres.	85
	30 Centimetres.	1 25
	50 Centimetres.	2 00

For Graduations, see page 59.

# Tempered Steel Rules, No. 315.

## WITH FIGURED GRADUATIONS.



315

These Rules are furnished with the 64th graduations numbered every eighth graduation line; as 8, 16, 24, etc. This assists the user in quickly ascertaining the number of 64ths in 1-8", 1-4", 1-2", 3-4", etc.

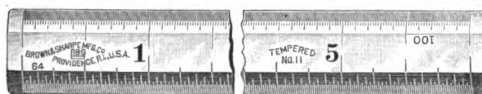
318

These Rules are furnished with No. 4 Graduation only.

No.	Length.	Approximate Width.	Approximate Thickness.	Price.
315	1"	29-64"	1-20"	\$0 20
	2	1-2	1-20	30
	3	35-64	1-20	40
	4	19-32	1-20	50
	6	11-16	1-20	65
	9	53-64	1-20	1 00
	12	31-32	1-20	1 25
	18	1	1-20	2 00
	24	1	1-20	2 50

# Tempered Steel Rules, No. 318.

## WITH BEVELED EDGES.

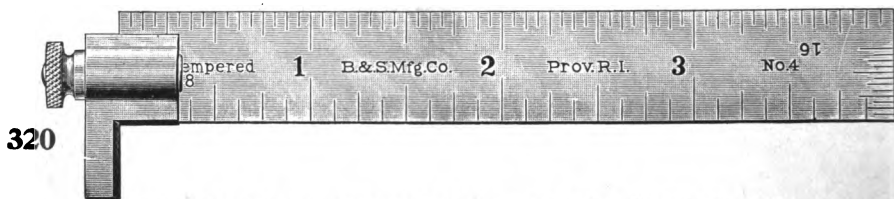


These Rules are beveled on both edges of one side, and are graduated on the beveled edges only.

No.	Length.	Approximate Width.	Number of Graduation.	Price.
318	1"	5-8"	10 & 11	\$0 20
	2	5-8	10 & 11	30
	3	5-8	10 & 11	40
	4	5-8	10 & 11	50
	6	11-16	10 & 11	65
	9	53-64	10 & 11	1 00
	12	1	10 & 11	1 25
	18	1	10 & 11	2 00
	24	1	10 & 11	2 50

For Graduations, see page 59.

## Tempered Hook Rules, No. 320.



These rules are found convenient for measuring diameters of flanges or circular pieces, through the hubs of pulleys, setting calipers and dividers and work of a similar character.

The hook is held rigidly in position by the simple tightening of the knurled nut shown at the left. The hook is carefully hardened.

No.	Length.	Approximate Width.	Number of Graduations.	Price.
<b>320</b>	4"	19-32"	1, 2, 4, 6 or 7	\$0 85
	6	11-16	1, 2, 4, 6 or 7	1 00
	9	53-64	1, 2, 4, 6 or 7	1 40
	12	31-32	1, 2, 4, 6 or 7	1 75
	18	1	1, 2, 4, 6 or 7	2 50
	24	1	1, 2, 4, 6 or 7	3 00
	36	1	1, 2, 4, 6 or 7	5 75

## Narrow Tempered Hook Rules, No. 325.



These rules are similar in construction to the No. 320 rules described above. They differ only in that this rule is narrow and allows measurements to be taken through a hole 3-8" in diameter.

No.	Length.	Number of Graduations.	Price.
<b>325</b>	4"	10, 11 or 12	\$0 75
	6	10, 11 or 12	90
	9	10, 11 or 12	1 25
	12	10, 11 or 12	1 50

Hook Rules furnished with metric graduations when ordered. Prices as listed above. For Graduations, see page 59.



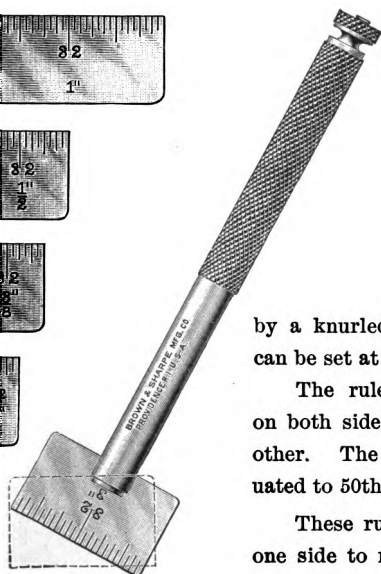
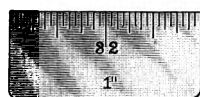
# Steel Rules with Holder, No. 335.

ENGLISH OR METRIC MEASURE.

5 Rules Interchangeable in One Holder.

Price, \$1 50.

335



The rules and holder, shown full size, are convenient where the ordinary rule cannot be used, as in measuring a recess or keyway as well as the general class of tool and die work.

The holder takes either of the five sizes of rules. The barrel is knurled for finger grip. The rules are held in a split chuck, adjusted

by a knurled nut at the top of the barrel and can be set at various angles according to the work.

The rules are of tempered steel, graduated on both sides, 32ds on one side and 64ths on the other. The 1" and 1-2" are also furnished graduated to 50ths on one side and 100ths on the other.

These rules are also furnished graduated on one side to millimetres and on the other side to half-millimetres.

Separate parts can be bought as follows:

Length.	Without Holder.	With Holder.
1-4" or 5 m/m	\$0 20	\$0 70
3-8" or 10 m/m	20	70
1-2" or 15 m/m	20	70
3-4" or 20 m/m	20	70
1" or 25 m/m	20	70

Holder, . . . . . Price, \$0 50

# Tempered Steel Shrink Rules.

Nos. 340, 341, 342, 343, 344, 345 and 346.

340



## ENGLISH MEASURE.

341

	Number.	Shrink per Foot.	Length.	No. of Graduation.	Price.
342	340	1-10"	6 1-20"	2	\$0 75
		1-10	6 1-20	4	75
		1-10	12 1-10	2	1 75
		1-10	12 1-10	4	1 75
		1-10	24 1-5	2	3 50
343	341	1-10	24 1-5	4	3 50
		1-8	6 1-16	4	75
		1-8	6 1-16	2	75
		*1-8	6 1-16	10	75
		1-8	12 1-8	4	1 75
344	341	1-8	12 1-8	2	1 75
		1-8	24 1-4	4	3 50
		1-8	24 1-4	2	3 50
		*1-8	12 1-8	10	1 75
		*1-8	24 1-4	10	3 50
345	342	3-16	6 3-32	4	75
		3-16	6 3-32	2	75
		3-16	12 3-16	4	1 75
		3-16	12 3-16	2	1 75
		3-16	24 3-8	4	3 50
346	342	3-16	24 3-8	2	3 50
		1-4	6 1-8	4	75
		1-4	6 1-8	2	75
		1-4	12 1-4	4	1 75
		1-4	12 1-4	2	1 75
	343	1-4	24 1-2	4	3 50
		1-4	24 1-2	2	3 50
		5-16	12 5-16	4	1 75
		5-16	24 5-8	4	3 50
		5-32	12 5-32	4	1 75
	345	5-32	24 5-16	4	3 50
		3-8	12 3-8	4	1 75
		3-8	24 3-4	4	3 50

\*These sizes are graduated as Standard Rules on one side and Shrink Rules on the other, and to 32ds and 64ths on both sides. The others are graduated as Shrink Rules on both sides.

For Graduations, see page 59

# Standard Steel Rules, No. 350.

These Rules are Not Tempered.

No.	Length.	Approx. Width.	No. of Graduations.	Price.	
<b>350</b>	1"	7-16"	4 or 7	\$0 20	<b>350</b>
	2	1-2	4, 7 or 9	30	
	3	5-8	1, 2, 4, 6 or 7	40	
	4	3-4	1, 2, 4, 6 or 7	50	
	6	1	1, 2, 4, 6 or 7	65	<b>351</b>
	9	1	1, 2, 4, 6 or 7	1 00	
	12	1	1, 2, 4, 6 or 7	1 25	
	12	1	5	2 50	
	18	1 1-2	1, 2, 4, 6 or 7	2 00	<b>352</b>
	24	1 1-2	1, 2, 4, 6 or 7	2 50	
	24	1 1-2	5	5 00	
	36	2	1, 2, 4, 6 or 7	5 00	
	48	3	1, 2, 4, 6 or 7	7 00	

For Graduations, see page 59.

Standard Steel Rules, 2" to 12", with No. 4 graduations are made with patent end graduations. 2" and 4" Rules are graduated to 32ds, 48ths, 56ths and 100ths of an inch; the 6" to 12" to 28ths, 32ds, 48ths and 100ths of an inch; the 3" Rules are graduated to 32ds, 40ths, 48ths and 56ths of an inch. See cut on page 59.

# Standard Steel Rules, No. 351.

METRIC MEASURE.

These Rules are Not Tempered.

No.	Length.	Price.
<b>351</b>	5 Centimetres.	\$0 30
	10 Centimetres.	50
	20 Centimetres.	85
	30 Centimetres.	1 25
	50 Centimetres.	2 00
	1 Metre.	7 00

First corner graduated to 1-2 m/m; remaining corners graduated to 1 m/m.

# Standard Steel Rules, No. 352.

ENGLISH AND METRIC MEASURE.

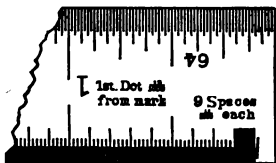
These Rules are Not Tempered.

No.	Length.	Price.
<b>352</b>	*5 Centimetres.	\$0 30
	*10 Centimetres.	50
	20 Centimetres.	85
	30 Centimetres.	1 25
	50 Centimetres.	2 00
	1 Metre.	7 00

First corner graduated to 1-2 m/m; second corner to 1 m/m; third corner, 2 inches to 1-64, the remainder to 1-16 of an inch; fourth corner, 2 inches to 1-100, the remainder to 1-50 of an inch.

\* First corner graduated to 1-2 m/m, second corner to 1 m/m, third corner to 1-64 of an inch, fourth corner to 1-100 of an inch.

## Improved Graduation on Standard Steel Rules.



1st Dot,  $\frac{1}{1000}$ " from line.

Each Dot adds  $\frac{1}{1000}$ ".

9 Spaces,  $\frac{1}{1000}$ " each.

Standard Steel Rules, with No. 7 Graduations, to and including 24" in length, furnished with this device when so ordered without additional cost.

This improvement consists of a series of graduations, at the end of a scale of hundredths, as follows:

Nine spaces of eleven thousandths of an inch each and a diagonal line of eight dots, the one nearest the edge of the rule being twelve thousandths of an inch from the last line, the second thirteen thousandths, and so on, each dot one thousandth of an inch farther from the line than the one preceding.

By the use of the eleven thousandths graduation, measurements, from one-tenth of an inch to any length on the scale, can be made by thousandths of an inch and, by making use of the line of dots, dividers can be set by thousandths from one-hundredth of an inch to any part of the scale.

**Method of Using.** For measurements less than .100" use:

The long lines shown at the right for measurements that are multiples of 11. }

The long lines and 1-100" space lines at the left, for measurements that are the sums of multiples of 10 and 11.

The long lines and dots for measurements not included above.

The following measurements will illustrate the application of the foregoing:

Required Measurement.	Method of Obtaining Measurements.		
	.011" Spaces.	.010" Spaces.	Dots.
.051"	1	4	0
.052	2	3	0
.053	3	2	0
.054	4	1	0
.055	5	...	0
.056	4	..	1
.057	4	...	2
.058	4	...	3
.059	4	...	4
.060	...	6	0

When using the eleven-thousandth spaces and the dots, remember that the space between the long line and first dot is the same as one .011" space plus .001" and reads .012".

For measurements greater than .100" multiply the thousandth figure by 11, and subtract this result from the required measurement.

Proceed as follows:

Place one leg of the dividers in the line corresponding to the figure multiplied by 11 and the other leg in the hundredths line, corresponding to the hundredths found in the difference.

For example: To measure .736", multiply 6 by 11, and subtract the result, 66, from the distance to be measured —  $.736 - 66 = .670$ .

Then place one leg of the dividers in the line registering the sixth .011" space; this, as the first of these lines is 0, will be the seventh line. Read back from this same 0 sixty-seven of the 1-100" spaces and the dividers will be open .736".

Required 1.743".  $1.743 - 33 = 1.710$ . Place one leg of the dividers in the line registering the 6th .011" space, and the other in the 171st 1-100" line.

For prices, see page 67

## Narrow Steel Rule, No. 353.

These Rules are Not Tempered.



353

Price, 65 Cents.

360

We carry in stock a steel rule, not tempered, 6" long, about 11-16" wide and furnish it with Nos. 1, 2, 4, 6 or 7 graduations. This rule corresponds to the Standard Steel Rule but is lighter. For Graduations, see page 59.

365

## Square Steel Rules, No. 360.



No.	Length.	Number of Graduations.	Price.
<b>360</b>	3"	4, 7 or 17	\$0 45
	4	4, 7 or 17	60
	6	4, 7 or 17	90

These Rules are divided into Parts of an Inch as follows:

No. 4 Graduation.	No. 7 Graduation.	No. 17 Graduation.
1st cor. 8	16	16
2d cor. 16	32	50
3d cor. 32	64	64
4th cor. 64	100	100

## Triangular Steel Rules, No. 365.



No.	Length.	Number of Graduations.	Price.
<b>365</b>	3"	20, 21 or 22	\$0 50
	4	20, 21 or 22	70
	6	20, 21 or 22	1 00
	12	20, 21 or 22	2 00

These Rules are divided into Parts of an Inch as follows:

No. 20 Graduation.	No. 21 Graduation.	No. 22 Graduation.
1st cor. 16	16	12, 24, 48
2d cor. 64	32	20, 50, 100
3d cor. 100	64	16, 32, 64

## Standard Steel Yard Measure, No. 370.

Price, \$3 00.

This measure is 1" wide, 1-8" thick. It is divided into inches and 1-8ths of an inch on one side and into 1-16, 1-8, 1-4, 3-8, 1-2, 5-8, 3-4 and 7-8 of a yard on the other. 370

## Work Basket Rule, No. 372.

372

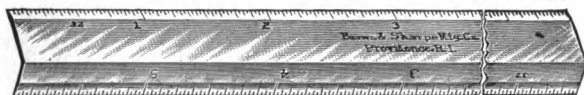
Price, 50 cents.

The rule is 6" long, 1" wide and 1-40" thick, made of steel and nickel plated. It is light and serviceable and is graduated on one side to 8ths and on the other side to 8ths and 16ths of an inch. 374

## Key Seat Rules, No. 374.

375

ENGLISH MEASURE.



Parallel lines for key seats, mortises, etc., can be readily and accurately drawn with these rules on shafts not less than 7-8" in diameter.

The edges are beveled, and graduated to 32ds of an inch.

No.	Length.	Price.
<b>374</b>	4"	\$2 50
	6	3 00
	8	3 75

## Key Seat Rules, No. 375.

METRIC MEASURE.

These rules differ from those above only in reading to metric measure, and being graduated to half-millimetres.

No.	Length.	Price.
<b>375</b>	10 c/m	\$2 50
	15	3 00
	20	3 75

# No. 377 Steel Gear Rules.

## ENGLISH MEASURE.

377



**These Rules Greatly Facilitate the Measurement of Wheels to be Sized  
According to Diametral Pitch.**

**Price, \$3 00.**

### Style 1.

This Rule is 12" long and contains four lines of graduations upon each side, one each as follows: 18, 20, 22, 24, 26, 28, 30 and 32 parts of an inch, whole length.

The following example will explain the use of this Rule:

Required the outside diameter of a wheel to have 60 teeth of 20 pitch. Find 60 on the line graduated to 20ths, this is the pitch diameter of the required wheel; add to this two of the divisions. The result 62-20ths, is the outside diameter.

### Style 2.

This Rule is 12" long and is graduated 1" only on each end, as follows: 6, 7, 8, 9, 10, 11, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36 and 38 parts of an inch. The intermediate 10 inches are blank, except that the inch lines are made clear across the Rule.

The following example will explain the use of this Rule:

Required the outside diameter of a wheel to have 88 teeth of 10 pitch. Take 8 of the blank inches and 8 of the 10ths graduations, which gives the pitch diameter; add two to the 10ths graduations and the result, 8.5 inches, is the outside diameter.



## 6-Inch Rule With Slide, No. 380.

ENGLISH OR METRIC MEASURE.

380



385

**Price, \$1 25.**

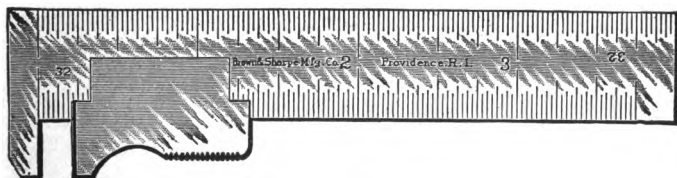
This Rule is 6" long, about 9-16" wide, 1-16" thick, and is furnished with Nos. 1, 2, 4, 6 or 7 Graduations.

For List of Graduations, see page 59.

The Metric Rules are graduated on three corners to millimetres and on one corner to half millimetres.

## Slide Caliper Rule, No. 385.

ENGLISH OR METRIC MEASURE.



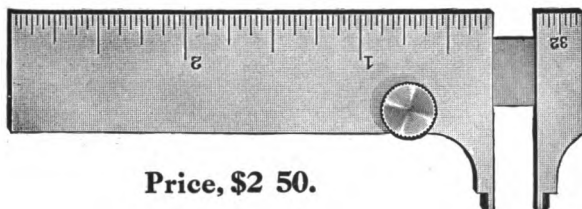
**Price, \$1 50.**

The Slide Caliper Rule, shown in cut, is of steel, 4 3-16" long and 1-16" thick. It is graduated on both corners to 32ds of an inch. The jaws are 3-8" deep.

The Metric Rules are graduated to half millimetres.

## Pocket Slide Caliper Rule, No. 388.

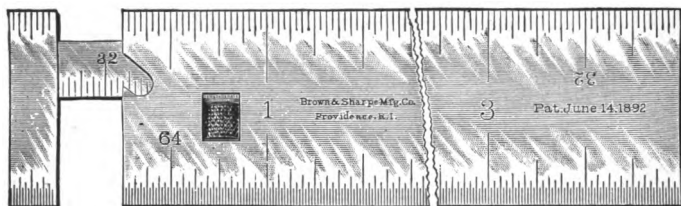
ENGLISH OR METRIC MEASURE.



Price, \$2 50.

Graduated on one corner of one side to read to 32ds. On the other side the slide is graduated to 64ths and has a range of 2". When the slide is set for any particular measurement it can be securely clamped in position by a clamp nut. The jaws are 5-8" deep. The nibs can be inserted in holes 1-8" in diameter. The Metric Rules are graduated to millimetres and half-millimetres.

## Steel Caliper Rules, No. 391.



No.	Length.	Price.
<b>391</b>	3" 4	\$2 50 3 00

These Rules are found convenient for use in the stock room or store, in selecting sheet or bar stock, wire, tubing, etc. The slide of the 3" can be drawn out to measure 2 1-4" and the 4" to measure 3 1-4".

The 3" rule can be furnished nickel plated when desired. Price, 15c. extra.

They are divided into Parts of an Inch as follows :

	A	B	C	D
1st cor.	8, 14, 28	8, 14, 28	8	8
2d cor.	12, 24, 48	12, 24, 48	16	16
3d cor.	16, 32, 64	16, 32, 64	32	32
4th cor.	20, 50, 100	20, 50, 100	64	64
Slide,	32 & 64	64 & 100	32 & 64	64 & 100

# Steel Caliper Rules, No. 392.

## METRIC MEASURE.

No.	Length.	Price.	392
392	75 m/m	\$2 50	397
	100 m/m	3 00	

The slide of the 75 m/m can be drawn out to measure 50 m/m and of the 100 m/m to measure 75 m/m. They are graduated to millimetres and half-millimetres.

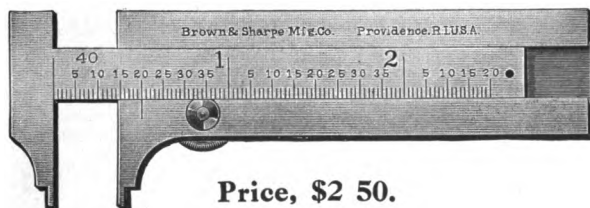
398

# Button Rule, No. 397.

Price, \$2 50.

This differs from the No. 391, 3" Steel Caliper Rule, only in that the outside is graduated to 16ths, 20ths, 32ds and 40ths of an inch and the slide to 40ths and 80ths of an inch.

# Pocket Button Rule, No. 398.



Price, \$2 50.

This Pocket Slide Caliper Rule or Button Rule is exceptionally convenient to use and it will fit easily into the pocket when not in use.

On one side it is graduated as an ordinary 3" rule, the graduations reading to 32ds. On the other side it is used as a button rule, the graduations on the slide reading to 40ths. It has a range of 2" and both external and internal measurements can be made.

When the slide is pulled out for measurements it can be securely clamped in position by the clamp nut.

## **B & S Protractors, Combination Squares and Combination Sets.**

---

These Protractors, Squares, and Sets are made with the same care and attention to detail as is shown in all of our tools.

The heads of the Squares are drop forged and superior to those of cast iron. This feature is readily appreciated by mechanics, as it contributes much to the lightness, durability and convenience of the tool.

In the Protractors the revolving turret which carries the blade is fitted to a nicety and accurately graduated, being engine divided to  $90^{\circ}$  either side of zero, and every care is taken to insure the zero being at right angles to the face of the head. It can be set at any angle and rigidly clamped by a thumb nut.

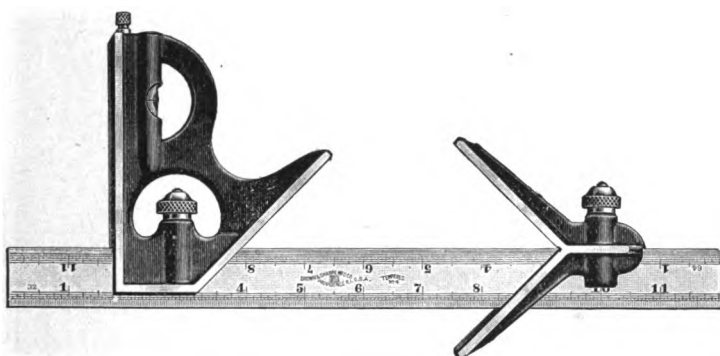
An important feature is the round clamping groove in the blade. This allows the head to be quickly clamped and forces the blade against the side of the slot, square with the face of the head. It also admits the use of a stronger blade and clamping bolt than does the usual square groove and presents no sharp corners to collect dirt and impair the accuracy of the tool.

Parallel lines running lengthwise of the blade are provided to aid in reading the various parts of an inch. The level, which is so important an adjunct to tools of this kind, is accurately set and fastened to the side of the turret.

Another important feature is that all parts of these squares are made interchangeable, thus allowing repairs to be made by simply ordering the part needed and avoiding the necessity of returning the tool.

The blades are furnished tempered as listed and are graduated with the same care and accuracy that have made our steel rules recognized as standards for accuracy.

# B & S Combination Squares.



400

402

404

406

408

410

## With Hardened Heads.

No.	Size.	Price.
<b>400</b> English	6 inch	\$2 50
	9 "	2 75
	12 "	3 00
	18 "	3 75
	24 "	4 25
<b>404</b> Metric	15 c/m	\$2 50
	20 "	2 75
	30 "	3 00
	50 "	3 75
	60 "	4 25
<b>408</b> Metric and English	15 c/m	\$2 50
	20 "	2 75
	30 "	3 00
	50 "	3 75
	60 "	4 25

## With Soft Heads.

No.	Size.	Price.
<b>402</b> English	6 inch	\$2 00
	9 "	2 25
	12 "	2 50
	18 "	3 25
	24 "	3 75
<b>406</b> Metric	15 c/m	\$2 00
	20 "	2 25
	30 "	2 50
	50 "	3 25
	60 "	3 75
<b>410</b> Metric and English	15 c/m	\$2 00
	20 "	2 25
	30 "	2 50
	50 "	3 25
	60 "	3 75

All blades are tempered.

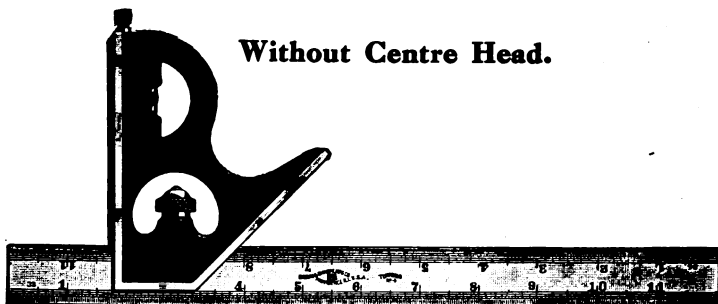
Blades on Nos. 400 and 402 have Nos. 1, 2, 4, 7 and 16 graduations. For List of Graduations, see page 59.

Blades on Nos. 404 and 406 are graduated as follows: 1st and 3d corners to millimetres; 2d and 4th corners to 1-2 millimetres.

Blades on Nos. 408 and 410 are graduated as follows: 1st corner to millimetres, 2d corner to 32ds of an inch, 3d corner to 1-2 millimetres, and the 4th corner to 64ths of an inch.

# B & S Combination Squares.

Without Centre Head.



## With Hardened Heads.

## With Soft Heads.

409	No.	Size.	Price.	No.	Size.	Price.
411	401 English	4 inch 6 " 9 " 12 " 18 " 24 "	\$1 50 2 00 2 25 2 50 3 25 3 75	403 English	4 inch 6 " 9 " 12 " 18 " 24 "	\$1 25 1 50 1 75 2 00 2 75 3 25
	405 Metric	10 c/m 15 " 20 " 30 " 50 " 60 "	\$1 50 2 00 2 25 2 50 3 25 3 75	407 Metric	10 c/m 15 " 20 " 30 " 50 " 60 "	\$1 25 1 50 1 75 2 00 2 75 3 25
	409 Metric and English	10 c/m 15 " 20 " 30 " 50 " 60 "	\$1 50 2 00 2 25 2 50 3 25 3 75	411 Metric and English	10 c/m 15 " 20 " 30 " 50 " 60 "	\$1 25 1 50 1 75 2 00 2 75 3 25

All blades are tempered.

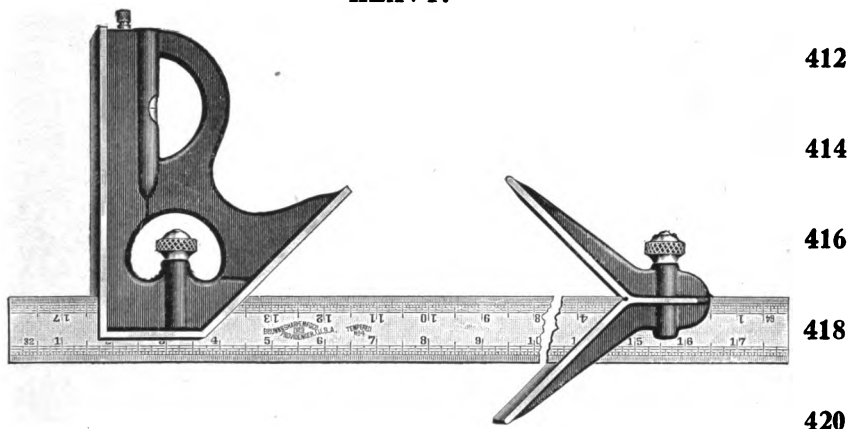
Blades on Nos. 401 and 403 have Nos. 1, 2, 4, 7 and 16 graduations. For List of Graduations, see page 59.

Blades on Nos. 405 and 407 are graduated as follows: 1st and 3d corners to millimetres; 2d and 4th corners to 1-2 millimetres.

Blades on Nos. 409 and 411 are graduated as follows: 1st corner to millimetres, 2d corner to 32ds of an inch, 3d corner to 1-2 millimetres, and the 4th corner to 64ths of an inch.

# B & S Combination Squares.

**HEAVY.**



With Hardened Heads.			With Soft Heads.		
No.	Size.	Price.	No.	Size.	Price.
<b>412</b> English	18 inch 24 "	\$6 25 7 25	<b>414</b> English	18 inch 24 "	\$5 75 6 75
<b>416</b> Metric	50 c/m 60 "	\$6 25 7 25	<b>418</b> Metric	50 c/m 60 "	\$5 75 6 75
<b>420</b> Metric and English	50 c/m 60 "	\$6 25 7 25	<b>422</b> Metric and English	50 c/m 60 "	\$5 75 6 75

All blades are tempered.

Blades on Nos. 412 and 414 have Nos. 1, 2, 4, 7 and 16 graduations. For List of Graduations, see page 59.

Blades on Nos. 416 and 418 are graduated as follows: 1st and 3d corners to millimetres; 2d and 4th corners to 1-2 millimetres.

Blades on Nos. 420 and 422 are graduated as follows: 1st corner to millimetres, 2d corner to 32ds of an inch, 3d corner to 1-2 millimetres, and the 4th corner to 64ths of an inch.

# B & S Combination Squares.

**HEAVY.**

**Without Centre Head.**

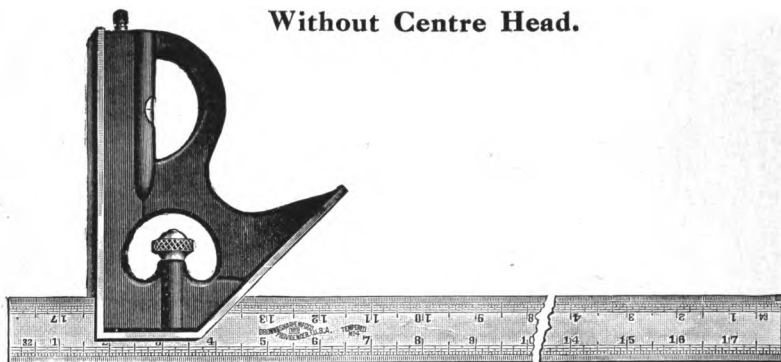
413

415

417

419

421



423

**With Hardened Head.**

**With Soft Head.**

No.	Size.	Price.	No.	Size.	Price.
<b>413</b> English	18 inch 24 "	\$4 75 5 75	<b>415</b> English	18 inch 24 "	\$4 25 5 25
<b>417</b> Metric	50 c/m 60 "	\$4 75 5 75	<b>419</b> Metric	50 c/m 60 "	\$4 25 5 25
<b>421</b> Metric and English	50 c/m 60 "	\$4 75 5 75	<b>423</b> Metric and English	50 c/m 60 "	\$4 25 5 25

All blades are tempered.

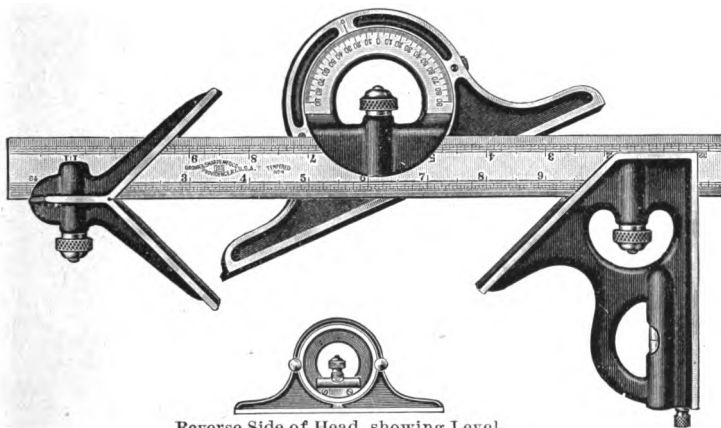
Blades on Nos. 413 and 415 have Nos. 1, 2, 4, 7 and 16 graduations. For List of Graduations, see page 59.

Blades on Nos. 417 and 419 are graduated as follows: 1st and 3d corners to millimetres; 2d and 4th corners to 1-2 millimetres.

Blades on Nos. 421 and 423 are graduated as follows: 1st corner to millimetres, 2d corner to 32ds of an inch, 3d corner to 1-2 millimetres, and the 4th corner to 64ths of an inch.



## B &amp; S Combination Sets.



Reverse Side of Head, showing Level.

With Square Heads Hardened.			With Soft Heads.		
No.	Size.	Price.	No.	Size.	Price.
<b>425</b> English	9 inch	\$4 75	<b>426</b> English	9 inch	\$4 25
	12 "	5 00		12 "	4 50
	18 "	5 75		18 "	5 25
	24 "	6 25		24 "	5 75
<b>429</b> Metric	20 c/m	\$4 75	<b>430</b> Metric	20 c/m	\$4 25
	30 "	5 00		30 "	4 50
	50 "	5 75		50 "	5 25
	60 "	6 25		60 "	5 75
<b>433</b> Metric and English	20 c/m	\$4 75	<b>434</b> Metric and English	20 c/m	\$4 25
	30 "	5 00		30 "	4 50
	50 "	5 75		50 "	5 25
	60 "	6 25		60 "	5 75

All blades are tempered.

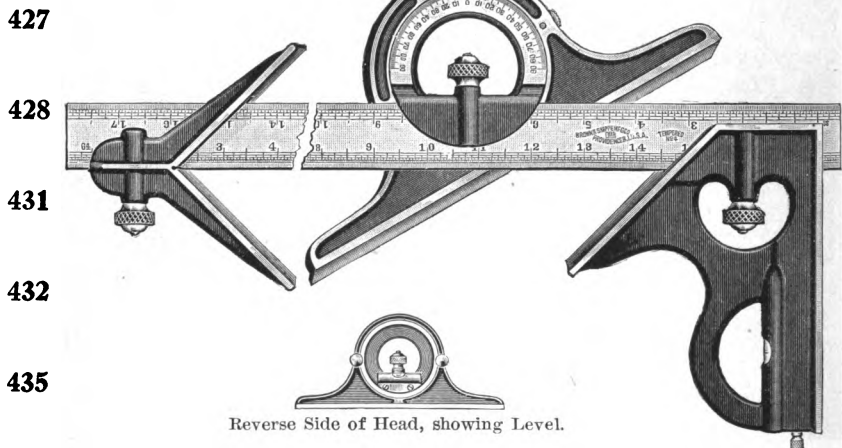
Blades on Nos. 425 and 426 have Nos. 1, 2, 4, 7 and 16 graduations For List of Graduations, see page 59.

Blades on Nos. 429 and 430 are graduated as follows: 1st and 3d corners to millimetres; 2d and 4th corners to 1-2 millimetres.

Blades on Nos. 433 and 434 are graduated as follows: 1st corner to millimetres, 2d corner to 32ds of an inch, 3d corner to 1-2 millimetres, and the 4th corner to 64ths of an inch.

# B & S Combination Sets.

**HEAVY.**



Reverse Side of Head, showing Level.

With Square Heads Hardened.			With Soft Heads.		
No.	Size.	Price.	No.	Size.	Price.
<b>427</b> English	18 inch 24 "	\$8 75 9 50	<b>428</b> English	18 inch 24 "	\$8 25 8 75
<b>431</b> Metric	50 c/m 60 "	\$8 75 9 50	<b>432</b> Metric	50 c/m 60 "	\$8 25 8 75
<b>435</b> Metric and English	50 c/m 60 "	\$8 75 9 50	<b>436</b> Metric and English	50 c/m 60 "	\$8 25 8 75

All blades are tempered.

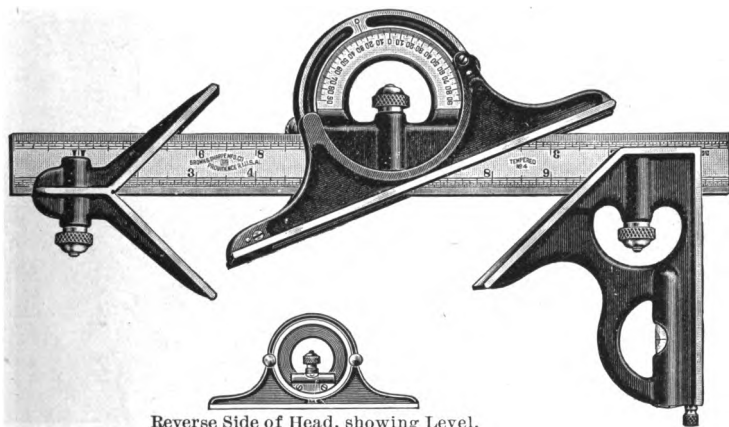
Blades on Nos. 427 and 428 have Nos. 1, 2, 4, 7 and 16 graduations. For List of Graduations, see page 59.

Blades on Nos. 431 and 432 are graduated as follows: 1st and 3d corners to millimetres; 2d and 4th corners to 1-2 millimetres.

Blades on Nos. 435 and 436 are graduated as follows: 1st corner to millimetres, 2d corner to 32ds of an inch, 3d corner to 1-2 millimetres, and the 4th corner to 64ths of an inch.

# B & S Combination Sets.

## With Reversible Protractor Head.



Reverse Side of Head, showing Level.

438

439

442

443

446

**With Square Heads Hardened.**

No.	Size.	Price.
<b>438</b> English	9 inch	\$5 25
	12 "	5 50
	18 "	6 25
	24 "	6 75
<b>442</b> Metric	20 c/m	\$5 25
	30 "	5 50
	50 "	6 25
	60 "	6 75
<b>446</b> Metric and English	20 c/m	\$5 25
	30 "	5 50
	50 "	6 25
	60 "	6 75

**With Soft Heads.**

No.	Size.	Price.
<b>439</b> English	9 inch	\$4 75
	12 "	5 00
	18 "	5 75
	24 "	6 25
<b>443</b> Metric	20 c/m	\$4 75
	30 "	5 00
	50 "	5 75
	60 "	6 25
<b>447</b> Metric and English	20 c/m	\$4 75
	30 "	5 00
	50 "	5 75
	60 "	6 25

447

All blades are tempered.

Blades on Nos. 438 and 439 have Nos. 1, 2, 4, 7 and 16 graduations. For List of Graduations, see page 59.

Blades on Nos. 442 and 443 are graduated as follows: 1st and 3d corners to millimetres; 2d and 4th corners to 1-2 millimetres.

Blades on Nos. 446 and 447 are graduated as follows: 1st corner to millimetres, 2d corner to 32ds of an inch, 3d corner to 1-2 millimetres and the 4th corner to 64ths of an inch.

# B & S Combination Sets.

HEAVY.

With Reversible Protractor Head.

440

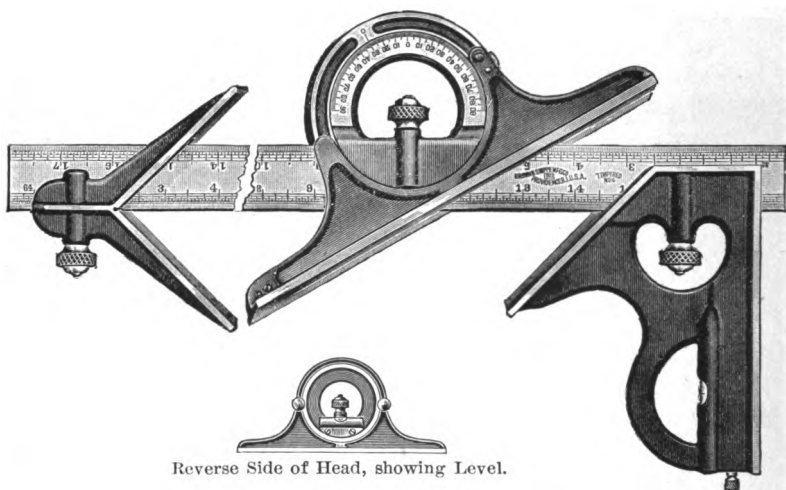
441

444

445

448

449



Reverse Side of Head, showing Level.

## With Square Heads Hardened.

No.	Size.	Price.
<b>440</b> English	18 inch 24 "	\$9 25 10 25
<b>444</b> Metric	50 c/m 60 "	\$9 25 10 25
<b>448</b> Metric and English	50 c/m 60 "	\$9 25 10 25

## With Soft Heads.

No.	Size.	Price.
<b>441</b> English	18 inch 24 "	\$8 75 9 50
<b>445</b> Metric	50 c/m 60 "	\$8 75 9 50
<b>449</b> Metric and English	50 c/m 60 "	\$8 75 9 50

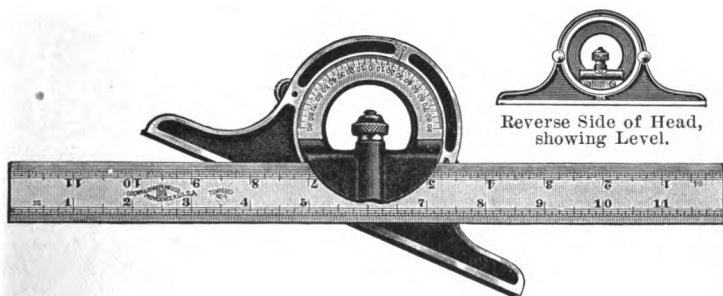
All blades are tempered.

Blades on Nos. 440 and 441 have Nos. 1, 2, 4, 7 and 16 graduations. For List of Graduations, see page 59.

Blades on Nos. 444 and 445 are graduated as follows: 1st and 3d corners to millimetres; 2d and 4th corners to 1-2 millimetres.

Blades on Nos. 448 and 449 are graduated as follows: 1st corner to millimetres, 2d corner to 32ds of an inch, 3d corner to 1-2 millimetres, and the 4th corner to 64ths of an inch.

## B & S Protractors.



450

452

454

No.	Size.	Price.
<b>450</b> English	9 inch	\$3 00
	12 "	3 25
	18 "	4 00
	24 "	4 50
<b>452</b> Metric	20 centimetres	\$3 00
	30 "	3 25
	50 "	4 00
	60 "	4 50
<b>454</b> Metric and English	20 centimetres	\$3 00
	30 "	3 25
	50 "	4 00
	60 "	4 50

All blades are tempered.

Blades on No. 450 have Nos. 1, 2, 4, 7 and 16 graduations. For List of Graduations, see page 59.

Blades on No. 452 are graduated as follows: 1st and 3d corners to millimetres; 2d and 4th corners to 1-2 millimetres.

Blades on No. 454 are graduated as follows: 1st corner to millimetres, 2d corner to 32ds of an inch, 3d corner to 1-2 millimetres, and the 4th corner to 64ths of an inch.

Protractor Head with Level for 9 inch and 20 centimetre.....	\$2 00
Protractor Head with Level for 12 inch and 30 centimetre.....	\$2 00
Protractor Head with Level for 18 inch and 50 centimetre.....	\$2 50
Protractor Head with Level for 24 inch and 60 centimetre .....	\$2 50

# B & S Protractors.

## HEAVY.

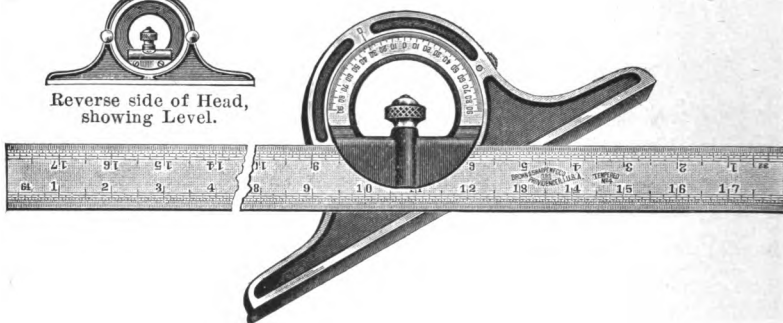
451

453

455



Reverse side of Head,  
showing Level.



No.	Size.	Price.
<b>451</b> English	18 inch 24 "	\$5 50 6 25
<b>453</b> Metric	50 centimetres 60 "	\$5 50 6 25
<b>455</b> Metric and English	50 centimetres 60 "	\$5 50 6 25

All blades are tempered.

Blades on No. 451 have Nos. 1, 2, 4, 7 and 16 graduations. For List of Graduations, see page 59.

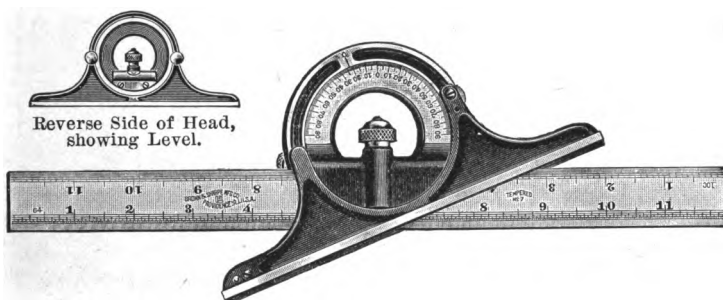
Blades on No. 453 are graduated as follows: 1st and 3d corners to millimetres; 2d and 4th corners to 1-2 millimetres.

Blades on No. 455 are graduated as follows: 1st corner to millimetres, 2d corner to 32ds of an inch, 3d corner to 1-2 millimetres, and the 4th corner to 64ths of an inch.

Protractor Head with Level for 18 inch and 50 centimetre.....\$2 50  
Protractor Head with Level for 24 inch and 60 centimetre .....\$2 50

# B & S Protractors.

With Reversible Protractor Head.



456

458

460

No.	Size.	Price.
<b>456</b> English	9 inch	\$3 50
	12 "	3 75
	18 "	4 50
	24 "	5 00
<b>458</b> Metric	20 centimetres	\$3 50
	30 "	3 75
	50 "	4 50
	60 "	5 00
<b>460</b> Metric and English	20 centimetres	\$3 50
	30 "	3 75
	50 "	4 50
	60 "	5 00

All blades are tempered.

Blades on No. 456 have Nos. 1, 2, 4, 7 and 16 graduations. For List of Graduations, see page 59.

Blades on No. 458 are graduated as follows: 1st and 3d corners to millimetres; 2d and 4th corners to 1-2 millimetres.

Blades on No. 460 are graduated as follows: 1st corner to millimetres, 2d corner to 32ds of an inch, 3d corner to 1-2 millimetres, and the 4th corner to 64ths of an inch.

Protractor Head with Level for 9 inch and 20 centimetre.....	\$2 50
Protractor Head with Level for 12 inch and 30 centimetre.....	\$2 50
Protractor Head with Level for 18 inch and 50 centimetre.....	\$3 00
Protractor Head with Level for 24 inch and 60 centimetre.....	\$3 00

# B & S Protractors.

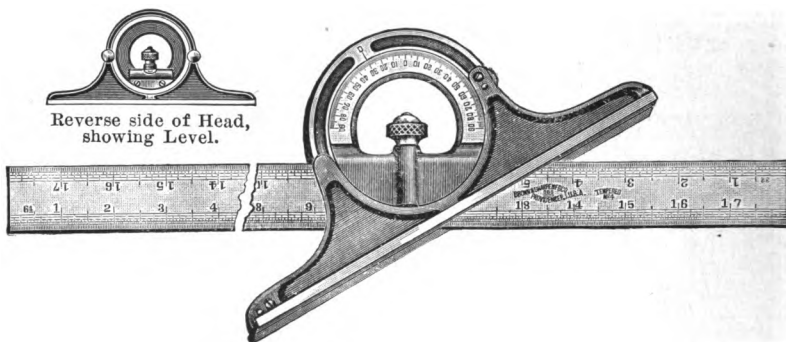
## HEAVY.

### With Reversible Protractor Head.

457

459

461



No.	Size.	Price.
<b>457</b> English	18 inch 24 "	\$6 00 6 75
<b>459</b> Metric	50 centimetres 60 "	\$6 00 6 75
<b>461</b> Metric and English	50 centimetres 60 "	\$6 00 6 75

All blades are tempered.

Blades on No. 457 have Nos. 1, 2, 4, 7 and 16 graduations. For List of Graduations, see page 59.

Blades on No. 459 are graduated as follows: 1st and 3d corners to millimetres; 2d and 4th corners to 1-2 millimetres.

Blades on No. 461 are graduated as follows: 1st corner to millimetres, 2d corner to 32ds of an inch, 3d corner to 1-2 millimetres, and the 4th corner to 64ths of an inch.

Protractor Head with Level for 18 inch and 50 centimetre. . . . . \$3 00  
 Protractor Head with Level for 24 inch and 60 centimetre. . . . . \$3 00



## Separate Parts

### For Combination Squares and Combination Sets.

Size.	Price of Blades.	Price of Heads.		Price of Centre Heads.	
	Tempered.	Soft.	Hardened.	Soft.	Hardened.
4" or 10 c/m	\$0 50	\$0 75	\$1 00		
6" or 15 c/m	75	1 00	1 25	\$0 75	\$1 00
9" or 20 c/m	1 00	1 00	1 25	1 00	1 25
12" or 30 c/m	1 25	1 25	1 50	1 00	1 25
18" or 50 c/m	2 00	1 25	1 50	1 00	1 25
24" or 60 c/m	2 50	1 25	1 50	1 00	1 25
18" or 50 c/m Heavy	2 50	1 75	2 00	1 50	1 75
24" or 60 c/m Heavy	3 50	1 75	2 00	1 50	1 75

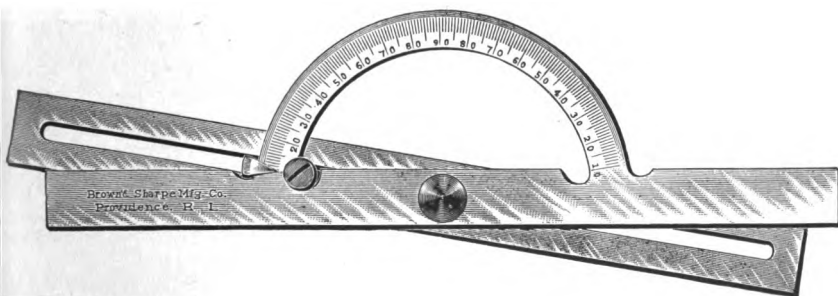
Scribers . . . . . 10 c. each.

Level Glasses . . . . . 10 c. each.

Level Glasses and setting same . . . 20 c. each.

492

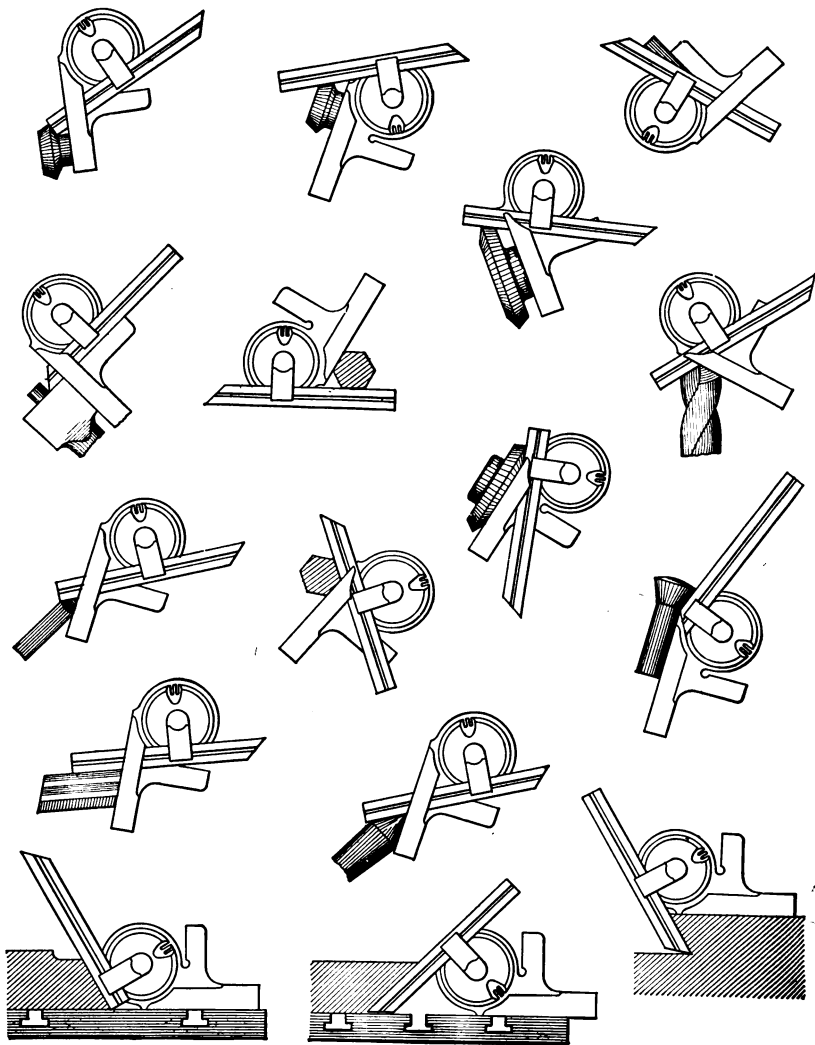
## Bevel Protractor, No. 492.



The half-circle is divided into degrees.

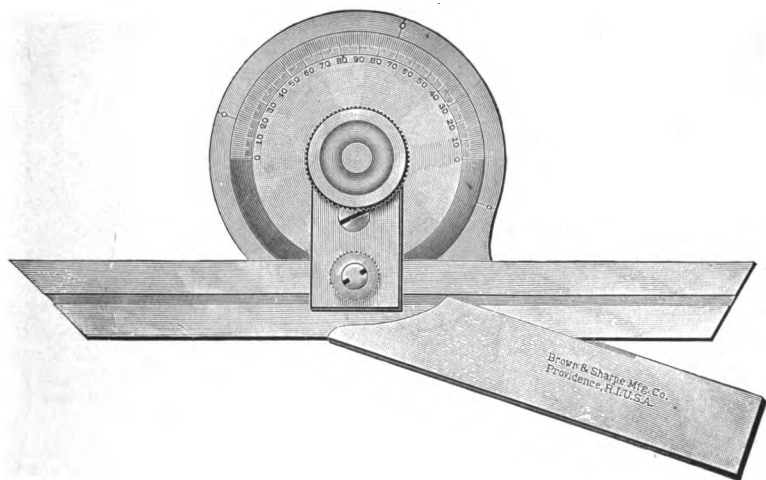
Number.	Length of Sliding Arm.	Price.
<b>492</b>	6" 10	\$4 50 5 75

## Different Uses of the Bevel Protractor.



## Improved Bevel Protractor, No. 493.

493



- |   |                |                              |
|---|----------------|------------------------------|
| Protractor with 6" blade.                 | Price, \$7 00. | In Leatherette Case, \$7 75. |
| Protractor with 12" blade.                | Price, \$8 00. | In Leatherette Case, \$9 00. |
| Protractor with both 6" and 12" blades. } | Price, \$8 50. | In Leatherette Case, \$9 50. |

This Protractor is well adapted for all classes of work, where angles are to be laid out or established, which do not require such a fine degree of accuracy as is possible with a Protractor having a Vernier.

One side of the stock is flat, thus permitting its being laid flat upon the paper or work.

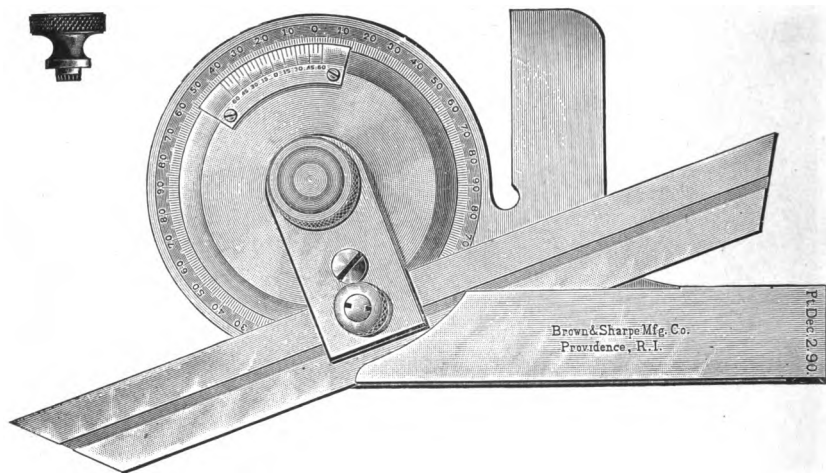
The dial is accurately graduated to degrees over an arc of 180°, reading 0 to 90° from each extremity of the arc. It turns on a large central stud, which is hardened and ground and can be rigidly clamped in any position after setting.

The blade is about 1-16" thick, can be moved back and forth its entire length and clamped independently of the dial, thus adapting this Protractor for work where others cannot be used.

# Improved Universal Bevel Protractor.

## No. 495.

495



Protractor with 6" blade.	Price, \$10 00.	In Morocco Case, \$11 00.
Protractor with 12" blade.	Price, \$11 00.	In Morocco Case, \$12 50.
Protractor with both 6" and 12" blades. }	Price, \$11 75.	In Morocco Case, \$13 75.

This Protractor is well adapted for all classes of work where angles are to be laid out or established.

One side of the stock is flat, thus permitting its being laid flat upon the paper or work.

The dial is accurately graduated to degrees the entire circle. The swivel turns on a large central stud, which is hardened and ground and can be rigidly clamped by a thumb nut.

The line of graduations is below the surface, protecting them from wear.

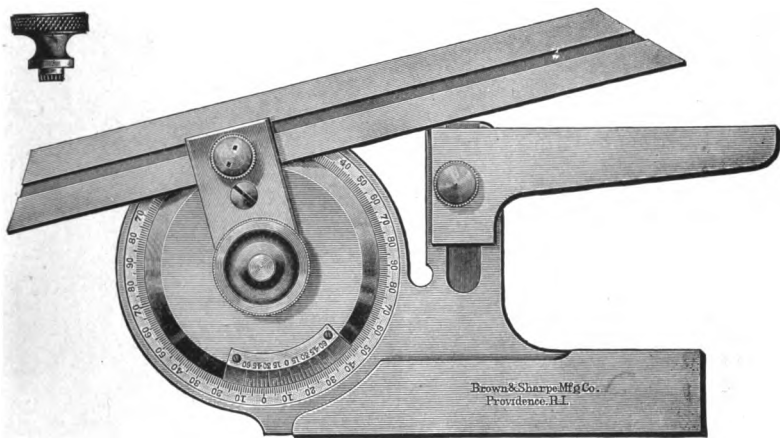
The Vernier adds materially to the use of the Protractor in obtaining fine measurements. It reads to 5 minutes or 1-12 of a degree.

By means of a small thumb vinion furnished as an attachment, extremely fine adjustments can be secured.

The blade is about 1-16" thick, can be moved back and forth its entire length and clamped independently of the dial, thus adapting this Protractor for work where others cannot be used.

# Improved Universal Bevel Protractor.

## No. 496.



496

### WITH ACUTE ANGLE ATTACHMENT.

Protractor with 6" blade.	Price, \$12 50.	In Morocco Case, \$13 50.
Protractor with 12" blade.	Price, \$13 50.	In Morocco Case, \$15 00.
Protractor with both 6" and 12" blades. }	Price, \$14 25.	In Morocco Case, \$16 25.

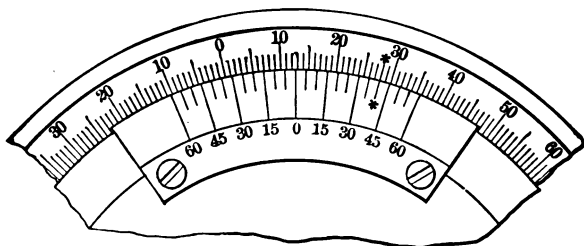
The Improved Universal Bevel Protractor with Acute Angle Attachment is designed for all classes of work where angles are to be laid out, and with the attachment, which is a new feature, extremely small angles can be easily and quickly established. All measurements are accurate, for the dial is accurately graduated, alignments correct, and workmanship throughout the best.

The Protractor can easily be laid on the work or paper, one side of the tool being flat. The dial is accurately graduated to degrees the entire circle, the graduated surface being depressed, thus protecting the graduations from wear.

A Vernier, which reads to 5 minutes or 1-12 of a degree, adds materially to the fineness to which angles can be laid out. A fine adjustment is provided by means of a small thumb screw furnished as an attachment.

The blade is about 1-16" thick, can be moved back and forth its entire length and clamped independently of the dial, thus adapting this Protractor for work where others cannot be used.

## Improved Universal Bevel Protractor.



### METHOD OF READING THE VERNIER.

The Vernier indicates every five minutes (5') or one-twelfth of a degree.

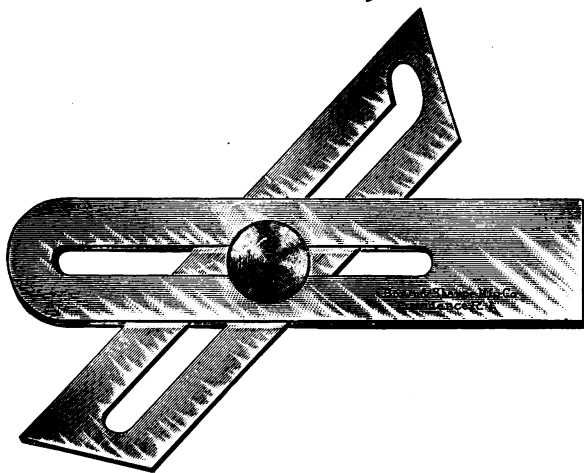
Each space upon the Vernier is 5' shorter than two spaces on the true scale.

When the line marked O on the Vernier coincides with the line marked O on the true scale, the edges of the base and blade are parallel. When the swivel head is moved so the line on the Vernier next to O coincides with the line next but one to O on the true scale, the included angle of the base and blade has been changed 1-12 of a degree or 5'.

**To Read the Protractor Setting.** Read off directly from the true scale the number of whole degrees between O and the O of the Vernier scale. Then count, in the same direction, the number of spaces from the zero of the Vernier scale to a line that coincides with a line on the true scale; multiplying this number by 5 the product will be the number of minutes to be added to the whole number of degrees.

For example: As the Vernier is shown in the cut it has moved 12 whole degrees to the right of the O upon the true scale and the 8th line on the Vernier coincides with a line upon the true scale as indicated by \*. Multiplying 8 by 5 the product, 40, is the number of minutes to be added to the whole number of degrees, thus indicating a setting of 12 degrees and 40 minutes ( $12^{\circ} 40'$ ).

## Universal Bevels, No. 498.

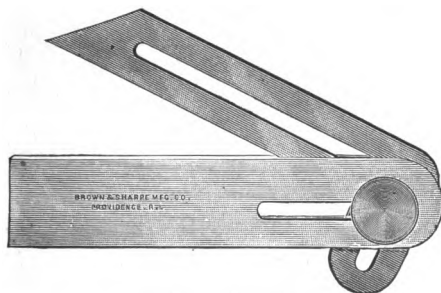


498

499

No.	Length of Head and Tongue.	Width of Head and Tongue.	Price.
<b>498</b>	3" 1 1-4	5-8" 1-4	\$1 25 1 25

## Improved Universal Bevel, No. 499.



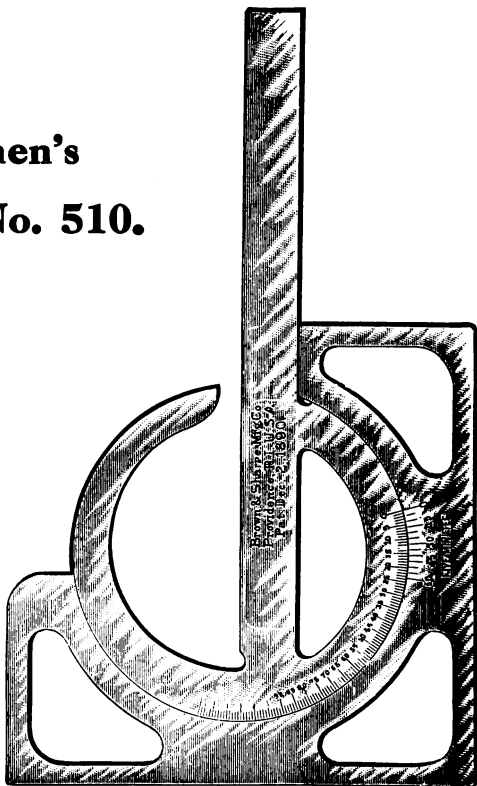
**Price, \$1 50.**

The above cut represents an Improved Universal Bevel, 3" long, with an offset blade that admits of the measurement of all angles.

The case is solid on the top for 1 1-2" from the square end.

**510      Draughtsman's  
Protractor, No. 510.**

**Price, \$6 50.  
In Morocco Case,  
\$7 75.**



**Cut About One-third Size.**

This Protractor can be quickly set to any angle. It can be used either side up and on either of the two outside edges of the frame. It can be used to advantage in dividing a circle, transferring angles or laying off a given angle, without resetting, on either side of a line.

The Vernier reads to five minutes.

It forms a convenient extension of a T square and frequently takes the place of  $45^{\circ}$  and  $60^{\circ}$  angles.



## Tables for use with Draughtsmen's Protractor.

### Table for Dividing Circles or Laying out Geometrical Figures.

No. of Sides.	Included Angle.	Angles at Centre of Circles.	Angles for Sides of Figures.
3	120°	30°	30°
4	90°	45°	45°
5	72°	18°—54°	36°—72°
6	60°	30°	30°
8	45°	45°	22° 30'
10	36°	54°—18°	18°—54°
12	30°	60°	15°—45°
14	25° 43'	64° 17'—38° 34'—12° 51'	12° 51'—38° 34'—64° 17'
16	22° 30'	67° 30'—45°	11° 15'—33° 45'
18	20°	70°—50°—30°—10°	10°—30°—50°—70°
20	18°	72°—54°	9°—27°—45°
24	15°	75°—60°—45°	7° 30'—22° 30'—37° 30'

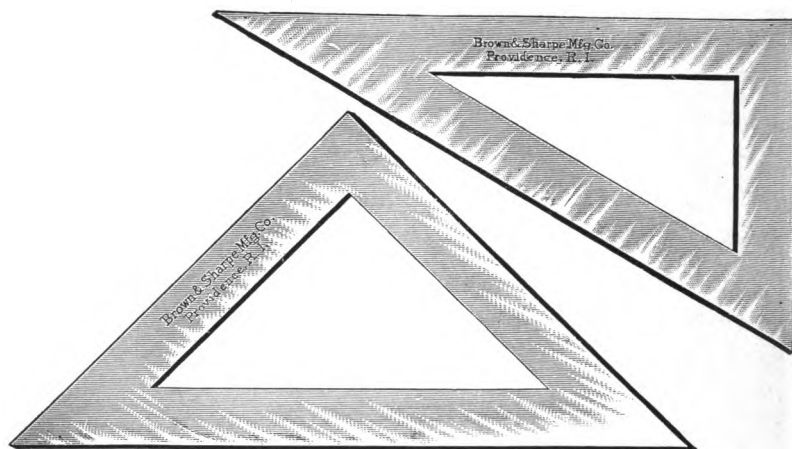
### Tapers per Foot and Corresponding Angles.

Taper Per Foot.	Included Angle.	Angle with Centre Line.	Taper Per Foot.	Included Angle.	Angle with Centre Line.
1-8"	0°—36'	0°—18'	1"	4°—46'	2°—23'
1-4	1°—12'	0°—36'	1 1-2	7°—09'	3°—35'
5-16	1°—30'	0°—45'	1 3-4	8°—20'	4°—10'
3-8	1°—47'	0°—54'	2	9°—31'	4°—46'
7-16	2°—05'	1°—02'	2 1-2	11°—54'	5°—57'
1-2	2°—23'	1°—12'	3	14°—15'	7°—08'
3-4	3°—35'	1°—47'	3 1-2	16°—36'	8°—18'
15-16	4°—28'	2°—14'	4	18°—55'	9°—28'

## No. 512 Open Steel Triangles

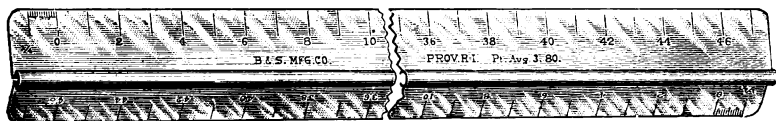
### FOR DRAUGHTSMEN.

512



No.	Angles.	Approximate Length of Sides.	Width of Sides.	Price.
Style 1	30°, 60°, 90°	6", 10 3-8", 12"	3-4"	\$4 00
Style 2	30°, 60°, 90°	3 1-2", 6 1-16", 7"	5-8	3 00
Style 3	45°, 45°, 90°	8", 8", 11 5-16"	3-4	4 00
Style 4	45°, 45°, 90°	5", 5", 7 1-16"	5-8	3 00

## Improved Scales for Draughtsmen.



These Scales are of steel, nickel plated, and are of a design combining lightness with strength. A 12" scale weighs but 2 1-2 oz. The underside of the scale is beveled thus bringing the graduated side close to the work, a distinct advantage in laying out work accurately. Each scale has a single graduation, alike on both sides, or two similar graduations, each side complete in itself. This eliminates the confusion of many dissimilar graduations.

See following page for list of Improved Scales for Draughtsmen.

# Improved Scales for Draughtsmen.

## Nos. 515, 516, 517.

### List of Scales for Architects, No. 515.

No.	Length.	Graduation.	Price.	
<b>515</b>	12"	3" = 1 foot.	\$1 25	<b>515</b>
	12	2" = 1 "	1 25	
	12	1 1-2" = 1 "	1 25	
	12	1" = 1 "	1 25	
	12	3-4" = 1 "	1 25	<b>516</b>
	12	1-2" = 1 "	1 25	
	12	1-4" = 1 "	1 25	
	12	1-8" = 1 "	1 25	
	6	1-2" = 1 "	1 00	
	6	1-4" = 1 "	1 00	
	6	3-16" = 1 "	1 00	
	6	1-8" = 1 "	1 00	
	6	3-32" = 1 "	1 00	
	12	3" and 1 1-2" = 1 foot.	1 25	
	12	1" " 1-2" = 1 "	1 25	
	12	3-4" " 1 1-2" = 1 "	1 25	
	12	3-8" " 3-16" = 1 "	1 25	
	12	1-4" " 1-2" = 1 "	1 25	
	12	1-4" " 1-8" = 1 "	1 25	
	20 cm.	1 mm. and 1-2 mm.	1 25	
	30 cm.	1 mm. and 1-2 mm.	1 25	

### List of Scales for Engineers, No. 516.

No.	Length.	Graduation.	Price.
<b>516</b>	12"	20ths of an inch.	\$1 25
	12	40ths " " "	1 25
	12	50ths " " "	1 25
	12	60ths " " "	1 25
	12	80ths " " "	1 25
	12	100ths " " "	1 25
	12	1-200th of a foot.	1 25
	12	1-250th " " "	1 25
	12	1-400th " " "	1 25
	12	1-500th " " "	1 25
	12	1-800th " " "	1 25
	12	1-1000th " " "	1 25
	12	10ths and 50ths of an inch.	1 25
	12	20ths " 30ths " " "	1 25
	12	20ths " 50ths " " "	1 25
	12	40ths " 30ths " " "	1 25
	12	20ths " 80ths " " "	1 25
	12	40ths " 50ths " " "	1 25
	12	40ths " 60ths " " "	1 25
	12	40ths " 80ths " " "	1 25
	12	40ths " 100ths " " "	1 25

# Improved Scales for Draughtsmen.

(Continued).

## Miscellaneous, No. 517.

517	No.	Length.	Graduation.	Price.
520		12"	on one side 1-16", other side 1-32" . .	\$1 25
		12	on one side 1-32", other side 1-64" . .	1 25
		12	on one side to 1-64", other side to 1-100" . .	1 25
		12	both sides to 1-100" . . . . .	1 25
521	517	6	on one side 1-16", other side 1-32" . .	1 00
		6	on one side 1-32", other side 1-64" . .	1 00
		6	on one side 1-64", other side 1-100" . .	1 00
		6	both sides to 1-100" . . . . .	1 00
522		12	to 32nds, 1-2" = 1" . . . . .	1 25
		12	{ on one side to 10ths (100ths last 3 in.) }	1 25
		12	{ other side to 12ths (48ths last 3 in.) }	1 25
		12	*2" = 1 foot . . . . .	1 25

\*Graduated on both sides alike, and figured from the same end. It is divided into 12ths of an inch, figured every 6th of an inch, and the first 1-6 on each side is divided into 8 parts.

## SPECIAL SCALES MADE TO ORDER.

Prices on Application.

## Triangular Metallic Scales,

Nos. 520, 521, 522 and 523.



These Patent Triangular Metallic Scales are made from brass tubing with the ends closed, nicked with a dull finish and weigh less than 3 1-2 ounces.

The ends of these scales are covered with hardened steel plates which slightly raise the scale from the paper.

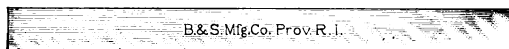
No. 520, Price, \$2 50. 12", divided to scales of 1-8, 1-4, 3-8, 1-2, 3-4, 1, 1 1-2, 2, 3 and 4 inches to the foot and 16ths of an inch.

No. 521, Price, \$2 50. 12", divided to scales of 3-16, 3-32, 1-8, 1-4, 3-8, 3-4, 1-2, 1, 1 1-2 and 3 inches to the foot and 16ths of an inch.

No. 522, Price, \$2 50. 12", divided on one edge each to 10ths, 20ths, 30ths, 40ths, 50ths and 60ths of inches.

No. 523, Price, \$2 50, divided on one edge each to 20ths, 30ths, 40ths, 50ths, 60ths and 80ths of an inch.

## Draughtsmen's Steel Straight Edges, No. 525.

**525**

No.	Length.	Width.	Approximate Thickness.	Price.	<b>526</b>
<b>525</b>	15"	1 1-4"	3-64"	\$0 90	
	18	1 1-2	3-64	1 00	
	24	1 1-2	3-64	1 50	
	30	1 3-4	3-64	2 25	
	36	2	1-16	3 00	
	42	2 1-4	1-16	4 00	
	48	2 1-2	1-16	6 00	
	60	2 3-4	5-64	8 00	
	72	2 3-4	5-64	10 00	

## Beveled Steel Straight Edges, No. 526.



The beveled edge is 1-16" thick.

Beveled on one edge only.

No.	Length.	Width.	Approximate Thickness.	Price.
<b>526</b>	12"	1 3-8"	3-16"	\$1 50
	18	1 3-4	3-16	2 50
	24	2	1-4	3 50
	36	3	1-4	6 00
	48	3	1-4	10 00
	60	3 1-8	9-32	15 00
	72	3 1-8	9-32	20 00

## Hardened Steel Straight Edges.

### No. 527.

**527**

**528** These Straight Edges are like the tongues of the Hardened Steel Try Squares and are hardened on the edges only.

No.	Length.	Width.	Approximate Thickness.	Price.
<b>527</b>	3 7-8"	15-16"	1-16"	\$0 60
	5 1-2	1 1-8	5-64	1 00
	7	1 3-8	5-64	1 25
	10 3-4	1 3-4	5-64	2 00
	14	2 1-16	5-64	3 00
	17	2 7-16	5-64	3 50
	20	2 7-8	7-64	4 50
	27	3	7-64	7 00
	33	3 1-4	1-8	9 00
	39	3 5-8	1-8	12 00

## Standard Steel Straight Edges.

### No. 528.



These Straight Edges are made from the best quality of steel and every care is taken to insure their being straight.

No.	Length.	Width.	Approximate Thickness.	Price.
<b>528</b>	6"	1"	5-64"	\$0 60
	9	1 1-16	5-64	90
	12	1 1-4	5-64	1 25
	18	1 1-2	3-32	2 00
	24	2	3-32	2 75
	36	2 1-2	7-64	5 00
	48	3	7-64	8 00
	60	3	1-8	12 00
	72	3	1-8	16 00

## Tool Makers' Knife Edge Straight Edges. No. 530.

These Straight Edges are for work that requires extreme accuracy. They are made from the best quality of steel and every care is taken to insure their being straight and true.

No.	Length.	Width.	Price.
<b>530</b>	2 1-4"	13-16"	\$2 75
	3 1-4	13-16	3 75
	4 1-2	13-16	4 75
	6 1-4	13-16	7 00

**530****531**

The above Straight Edges are furnished in cloth covered cases.

Test Bar, in cloth covered case, . . . . .	Price, \$4 00
Leather case for complete set, . . . . .	1 00
Cloth covered case for test bar, . . . . .	20
Cloth covered cases for straight edges, each . . . . .	15

## Tool Makers' Knife Edge Straight Edge Set. No. 531.



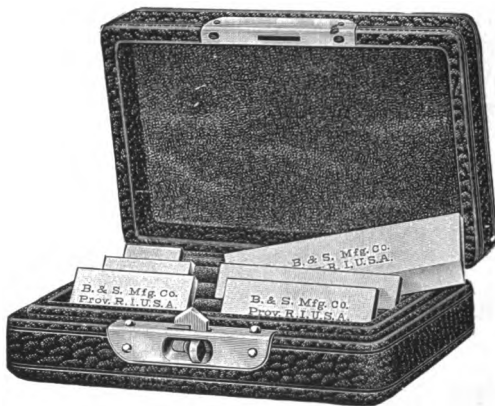
**Price, Complete in Leather Case, \$21 00.**

This set consists of Glass Test Bar and 4 Straight Edges, 1 each—2 1-4", 3 1-4", 4 1-2" and 6 1-4" long.

## Narrow Edge Straight Edges,

### No. 536.

536



**Price, Set Complete in Morocco Case,**

**\$2 50.**

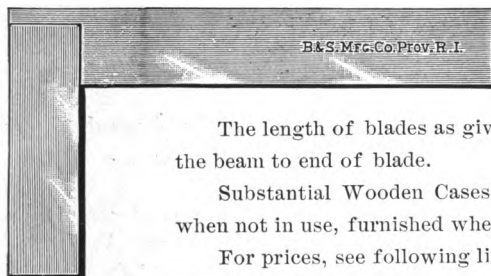
These Straight Edges are similar in design to our Beveled Edge Straight Edges, but are made of tempered steel, being  $\frac{5}{64}$ ths of an inch thick and 19-32ds of an inch wide.

The set comprises six lengths, 1-2", 8-4", 1", 1 1-4", 1 1-2" and 2".

These Straight Edges are useful in testing flanged and ball-bearing washers and are particularly adapted for toolmakers' use for testing surfaces where it would be impossible to use a regular straight edge.



# Hardened Cast Steel Try Squares, No. 540.



**Hardened.**

The length of blades as given is from the inner edge of the beam to end of blade.

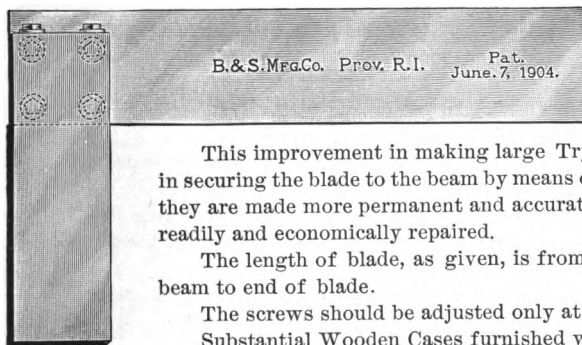
Substantial Wooden Cases for protecting the Squares when not in use, furnished when desired.

For prices, see following list.

No.	Length of Blade.	Length of Beam.	Price.	Price of Case.
<b>540</b>	1 1-2"	1 9-16"	\$2 25	\$0 50
	3	2 7-16	3 00	50
	4 1-2	3 9-16	4 50	50
	6	4 3-8	6 00	50
	9	5 5-8	9 00	50
	12	7 1-8	12 00	75
	15	8 3-16	20 00	1 00
	18	10 1-4	23 00	1 50

## IMPROVED

# Hardened Cast Steel Try Squares,



**No. 541.**

**Patented  
June 7, 1904.**

This improvement in making large Try Squares consists in securing the blade to the beam by means of screws, whereby they are made more permanent and accurate and can be more readily and economically repaired.

The length of blade, as given, is from the inner edge of beam to end of blade.

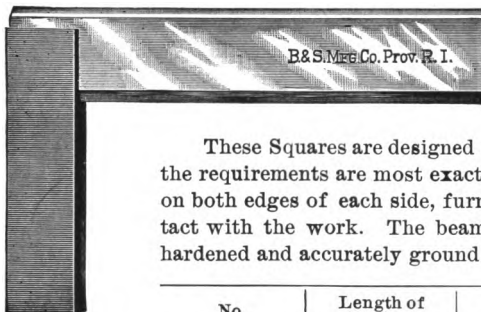
The screws should be adjusted only at our works.

Substantial Wooden Cases furnished with these Squares.

No.	Length of Blade.	Length of Beam.	Price.
<b>541</b>	24"	13 1-8"	\$30 00
	30	16 1-4	40 00
	36	19 1-2	50 00

## Steel Squares with Beveled Edges, No. 542.

542

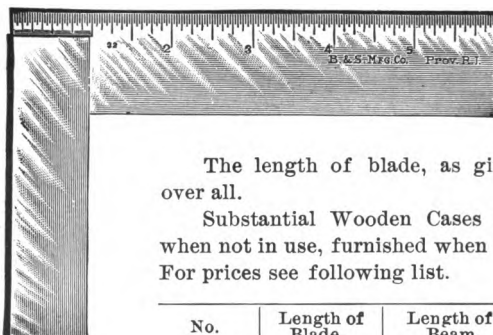
**Hardened.**

544

These Squares are designed for all classes of work where the requirements are most exacting. The blades are beveled on both edges of each side, furnishing practically a line contact with the work. The beams and edges of the blade are hardened and accurately ground for parallelism.

No.	Length of Blade.	Length of Beam.	Price.
<b>542</b>	1 1-2"	1 9-16"	\$2 75
	3	2 7-16	3 75
	4 1-2	3 9-16	5 50
	6	4 3-8	7 50

## Graduated Steel Squares, No. 544.

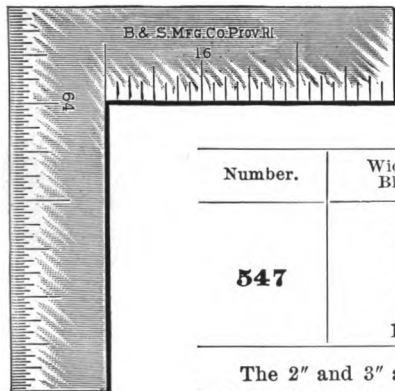
**Not Hardened.**

The length of blade, as given, is the extreme length over all.

Substantial Wooden Cases for protecting the Squares when not in use, furnished when desired, for the 9" and 12". For prices see following list.

No.	Length of Blade.	Length of Beam.	Price.	Price of Case.
<b>544</b>	3"	2"	\$2 50	
	4	2 9-16	3 75	
	6	3 3-4	5 00	
	9	5	8 00	\$0 50
	12	6 1-16	9 50	75

## 'Thin Steel Squares, No. 547.



**Graduated.**

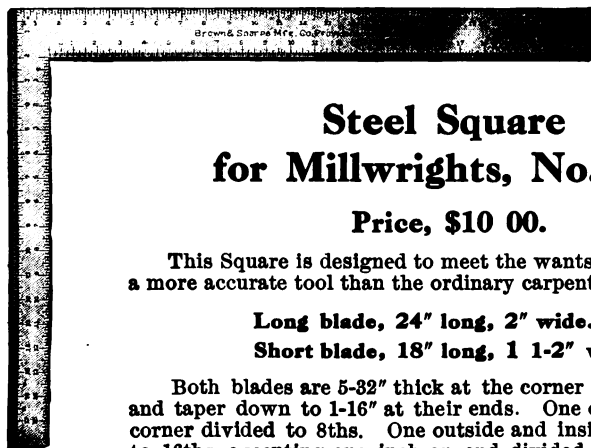
**547**

Number.	Width of Blade.	Width of Blade.	Price.
<b>547</b>	2"	1-2"	\$1 25
	3	5-8	1 75
	4	3-4	2 25
	6	1	3 25
	8	1 1-8	4 25
	10	1 1-4	5 25

**550**

The 2" and 3" are divided to 16ths and 64ths of an inch on one side and 32ds and 64ths on the other.

The 4", 6", 8" and 10" are divided on both sides to 16ths and 32ds of an inch.



## Steel Square for Millwrights, No. 550.

**Price, \$10 00.**

This Square is designed to meet the wants of those desiring a more accurate tool than the ordinary carpenter's square.

**Long blade, 24" long, 2" wide.**

**Short blade, 18" long, 1 1-2" wide.**

Both blades are 5-32" thick at the corner where they unite and taper down to 1-16" at their ends. One outside and inside corner divided to 8ths. One outside and inside corner divided to 16ths, excepting one inch on end divided to 64ths and the second inch from end divided to 32ds.

Both sides have similar graduations.

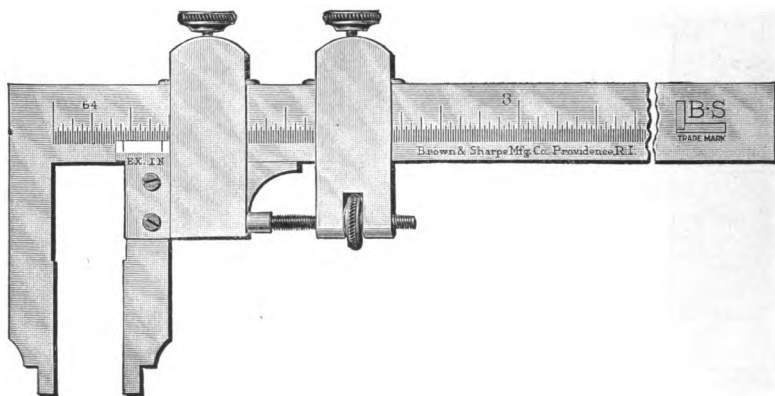
## Caliper Squares, No. 560, 561 and 562.

ENGLISH, METRIC AND ENGLISH AND METRIC MEASURE.

560

561

562



These Caliper Squares, listed on the following page, are convenient for a large class of work where extreme accuracy is not required, and are also valuable for use in duplicating work when the number of pieces will not warrant the expense of fixed gauges.

One jaw, or measuring point, is fixed, being an integral part of the bar: the other is carried by a sliding head that may be adjusted along the bar to increase or decrease the distance between the measuring points.

Quick adjustment of the points is secured by releasing both clamping screws and sliding the adjustable head the required distance along the bar.

Fine adjustment of the points may then be made by clamping the right hand screw and turning the knurled nut on the horizontal screw.

The 4", 6" and 9" Caliper Squares take inside as well as outside measurements. The 6" and 9" Squares have hardened jaws.

## Caliper Squares, No. 560.

### ENGLISH MEASURE.

No.	Size.	Length of Jaws.	Width of Jaws Closed.	Price without Adjusting Screw.	Price with Adjusting Screw.	Price of Leather Case, Extra.	
560	2"	3-4"		\$3 25	\$4 50	\$0 75	560
	*4	1			6 00	75	
	4	1 1-2	1-4"	5 50	6 50	75	561
	6	2	1-4	7 00	9 00	75	
	9	3 1-4	3-8	10 50	12 50	1 00	

Graduated on one side to 64ths, on the other to 100ths of an inch.

\*This Gauge is particularly adapted for boiler makers' use, steamboat inspectors and others, for measuring boiler plates. The jaws are designed for external measurements only.

## Caliper Squares, No. 561.

### METRIC MEASURE.

No.	Size.	Length of Jaws.	Width of Jaws Closed.	Price without Adjusting Screw.	Price with Adjusting Screw.	Price of Leather Case, Extra.
561	50 m/m	19 m/m		\$3 25	\$4 50	\$0 75
	100	38	6 m/m	5 50	6 50	75
	150	50	6	7 00	9 00	75
	250	80	10	10 50	12 50	1 00

Graduated on one side to 1-2 millimetres, on the other to 1 millimetre.

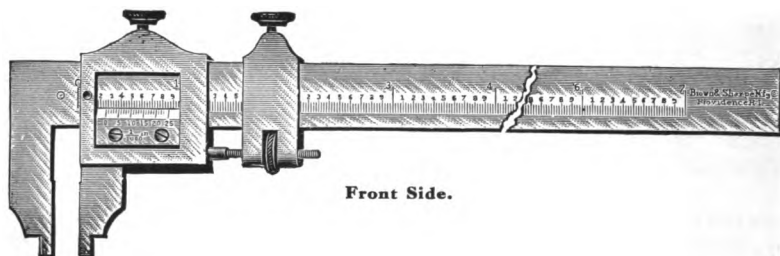
## Caliper Squares, No. 562.

### ENGLISH AND METRIC MEASURE.

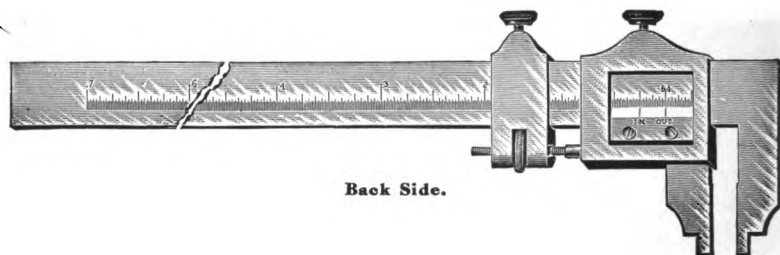
No.	Size.	Length of Jaws.	Width of Jaws Closed.	Price without Adjusting Screw.	Price with Adjusting Screw.	Price of Leather Case, Extra.
562	2"	3-4"		\$3 25	\$4 50	\$0 75
	4	1 1-2	1-4"	5 50	6 50	75
	6	2	1-4	7 00	9 00	75
	9	3 1-4	3-8	10 50	12 50	1 00

Graduated on one side to 1-2 millimetres, on the other to 100ths of an inch

## • Vernier Calipers.



Front Side.



Back Side.

These Vernier Calipers take inside as well as outside measurements. The jaws are hardened and ground. Points are placed on the bars and slides so that dividers can be set to transfer distances.

Vernier Calipers are furnished in cases unless otherwise ordered.

An explanation of the Vernier is sent with each Caliper.

A 1-4" Standard Internal Cylindrical Gauge is furnished when desired for testing the accuracy of the adjustment of the Caliper.

**Price, \$3 00 extra.**

## Vernier Calipers, No. 570.

### ENGLISH MEASURE.

These Vernier Calipers are graduated on the front to read, by means of a Vernier, to thousandths of an inch. They are graduated on the back to 64ths of an inch.

No.	Size.	Length of Jaws.	Width of Jaws closed.	Price.	Price Case Extra.
<b>570</b>	6"	1 1-4"	1-4"	\$18 00	\$1 00
	12	2 1-4	3-10	24 00	1 75
	24	2 1-4	3-10	33 00	3 00
	36	2 3-4	5-10	60 00	

570

571

572

## Vernier Calipers, No. 571.

### METRIC MEASURE.

These Calipers differ from Vernier Calipers No. 570, only in reading to Metric measure. They are graduated to read to 1-50th of a millimetre on one side and 1-2 of a millimetre on the other.

No.	Size.	Length of Jaws.	Width of Jaws closed.	Price.	Price Case Extra.
<b>571</b>	150 m/m	31 m/m	6 m/m	\$18 00	\$1 00
	300	57	6	24 00	1 75
	600	57	6	33 00	3 00
	900	69	12	60 00	

## Vernier Calipers, No. 572.

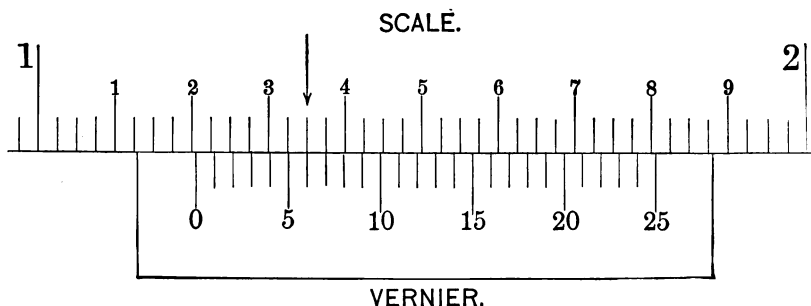
### ENGLISH AND METRIC MEASURE.

These Calipers differ from Vernier Calipers No. 571, only in reading to both English and Metric measure. They are graduated to read to .001 of an inch on one side and 1-50th of a millimetre on the other.

No.	Size.	Length of Jaws.	Width of Jaws closed.	Price.	Price Case Extra.
<b>572</b>	6"	1 1-4"	1-4"	\$18 00	\$1 00
	12	2 1-4	3-10	24 00	1 75
	24	2 1-4	3-10	33 00	3 00
	36	2 3-4	5-10	60 00	

All Vernier Calipers listed on this page are furnished in cases, unless otherwise ordered.

## Description of the Vernier and Its Use.



On the bar of the instrument is a line of inches numbered 0, 1, 2 etc., each inch being divided into ten parts and each tenth into four parts, making forty divisions to the inch. On the sliding jaw is a line of division (called a Vernier, from the inventor's name) of twenty-five parts, numbered 0, 5, 10, 15, 20, 25. The twenty-five parts on the Vernier correspond, in extreme length, with twenty-four parts or twenty-four fortieths of an inch on the bar, consequently each division on the Vernier is smaller than each division on the bar by one thousandth part of an inch. If the sliding jaw of the Caliper is pushed up to the other, so that the line marked 0 on the Vernier corresponds with that marked 0 on the bar, then the two next lines to the right will differ from each other by one thousandth of an inch and so the difference will continue to increase, one thousandth of an inch for each division, till they



again correspond at the line marked 25 on the Vernier. To read the distance the Caliper is open, commence by noticing how many inches, tenths and parts of tenths, the zero point on the Vernier has been moved from the zero point on the bar. Now count upon the Vernier the number of divisions, until one is found which coincides with the one on the bar, which will be the number of thousandths to be added to the distance read off on the bar. The best way of expressing the value of the divisions on the bar, is to call the tenths one hundred thousandths (.100) and the fourths of tenths, or fortieths, twenty-five thousandths (.025).

For example:

As the Vernier is shown in the cut it has been moved to the right, one and two-tenths inches, or 1.200", as indicated by the bar; and the sixth line on the Vernier coincides with a line on the bar, thus making six thousandths (.006) of an inch to be added to the reading from the scale, which would make the total reading one and two hundred and six thousandths inches (1.206").

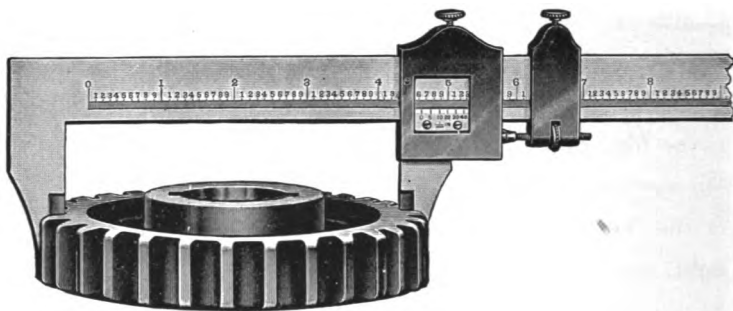
In making inside measurements with the 6" Vernier. Two and one-half tenths or two hundred and fifty thousandths (.250) of an inch and with the 12" and 24" Verniers, three tenths or three hundred thousandths (.300) of an inch should be added to the apparent reading on the Vernier side for the space occupied by the caliper points. With a Vernier Caliper reading to metric measure, add 6 m/m. When the other side of instrument is used no deduction is necessary, as there are two lines, one indicating inside and the other outside measurements.

## Vernier Caliper, No. 573.

**For Determining Accurately the Depth of Gear Teeth.**

**573**

**ENGLISH OR METRIC MEASURE.**



**Price, \$24 00.**

**Case Extra, \$1 75.**

**Furnished in case unless otherwise ordered.**

Measuring the bottom diameter of gears provides an accurate check on the cutting operation and insures the duplication of any desired standard.

This tool, therefore, is found especially valuable in the Automobile Shop for measuring automobile transmission gears where it is impossible to use our regular Vernier Calipers on account of the thickness of the jaws.

Outside of the measuring jaws this tool is exactly like our 12" Vernier Caliper and can be used as such.

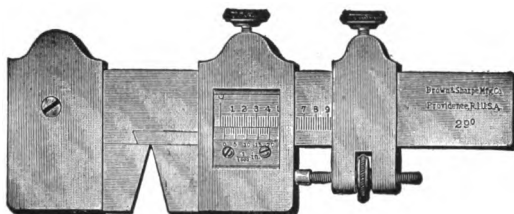
Depth of jaws, 1 7-8". Width of measuring surface, 1-32".

An explanation of the Vernier is sent with each Caliper.

# Thread Tool Vernier.

No. 576.

576



**60° Thread Tool Vernier, \$17 00.**

**Morocco Case, \$1 00 extra.**

**29° Thread Tool Vernier, \$17 00.**

**Morocco Case, \$1 00 extra.**

**55° Thread Tool Vernier, \$17 00.**

**Morocco Case, \$1 00 extra.**

Furnished in case unless otherwise ordered.

To the manufacturer looking for an extremely economical tool for measuring thread tools of different pitches, this tool is recommended. It does away with the large number of gauges formerly kept on hand.

When in use the sliding jaw is set for the width of point of tool of the required pitch. The thread tool is then ground so that the point bottoms on the hardened steel strip inserted in the blade and the sides rest against the jaws of the tool.

The jaws or measuring surfaces are carefully hardened and ground, the angle being carefully tested for accuracy. The Vernier reads to thousandths of an inch on one side of the tool, and to 50ths of a millimetre on the other side, and the graduations are made with as great care on these tools as on our regular Vernier calipers. The tool is graduated for one inch only.

## Gear Tooth Vernier, No. 580.

### ENGLISH MEASURE.

20 diametral to 2 diametral pitch.

Price, \$27 50.

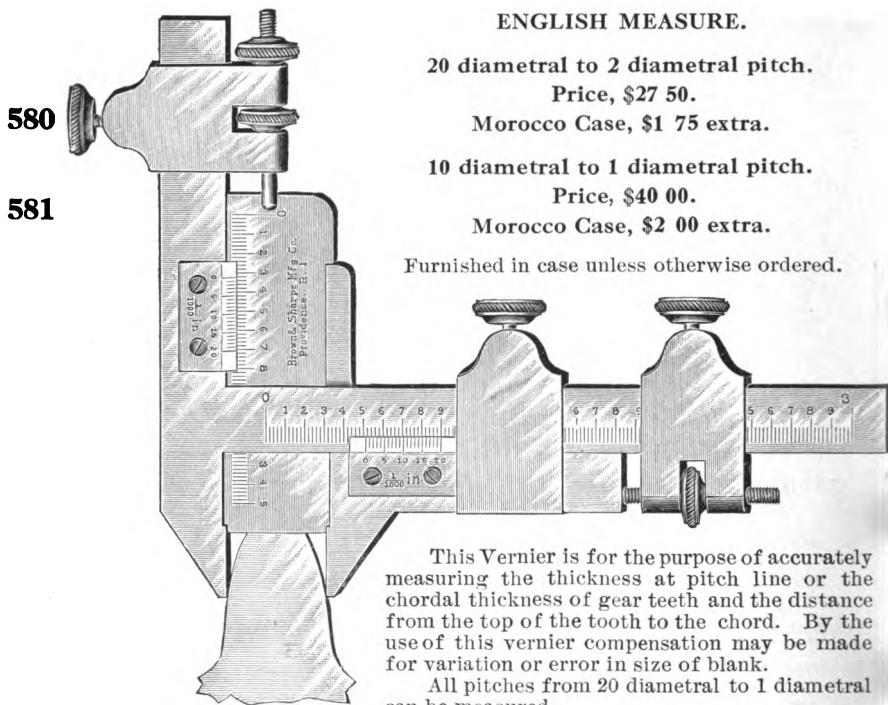
Morocco Case, \$1 75 extra.

10 diametral to 1 diametral pitch.

Price, \$40 00.

Morocco Case, \$2 00 extra.

Furnished in case unless otherwise ordered.



This Vernier is for the purpose of accurately measuring the thickness at pitch line or the chordal thickness of gear teeth and the distance from the top of the tooth to the chord. By the use of this vernier compensation may be made for variation or error in size of blank.

All pitches from 20 diametral to 1 diametral can be measured.

The sliding jaw moves upon a bar graduated to read, by means of a Vernier, to thousandths of an inch. A tongue, moving at right angles with the jaws, is graduated in the same manner.

Both the sliding jaw and tongue are provided with adjusting screws.

## Gear Tooth Vernier, No. 581.

### METRIC MEASURE.

1 1-4 m/m to 12 m/m Module.

Price, \$27 50.

Morocco Case, \$1 75 extra.

2 1-2 m/m to 25 m/m Module.

Price, \$40 00.

Morocco Case, \$2 00 extra.

Furnished in case unless otherwise ordered. This Vernier is graduated to read to 1-50th of a millimetre.

## Vernier Height Gauge, No. 585.

**8" ENGLISH, METRIC, AND ENGLISH AND METRIC MEASURE.**

**Price, \$30 00.**

**Morocco Case, \$1 75 extra.**

**18" ENGLISH OR METRIC MEASURE.**

**Price, \$75 00.**

**Wooden Box, \$3 00 extra.**

**585**

### 8" Gauge.

These Verniers are furnished in cases unless otherwise ordered.

This Height Gauge is used for obtaining the height of projections from a plane surface or the location of bushings in jigs, etc. The bar is 10" long, admits of measurements from 1" to 8" in height and is graduated to read by means of a vernier to thousandths of an inch. It reads on one side to outside measurements and on the other to inside measurements. The base is 2" long, 1" wide and 5-8" high, allowing gauge to stand upright, and is rounded on the end for use close to a projection. An extension for the movable jaw is furnished.

**Metric Measure.** Graduated to read to 1-50 m/m. It reads on one side to outside measurements and on the other to inside measurements.

**English and Metric Measure.** Graduated to read to 1-50 m/m on one side and to thousandths of an inch on the other. All measurements outside only.

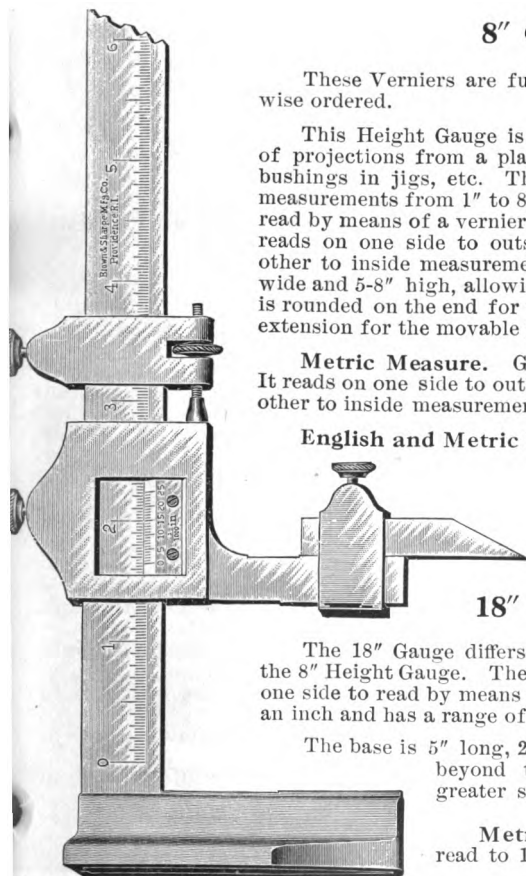
### 18" Gauge.

The 18" Gauge differs slightly in construction from the 8" Height Gauge. The bar is 20" long, is graduated on one side to read by means of a vernier to thousandths of an inch and has a range of 2" to 18".

The base is 5" long, 2" wide, 7-8" high and extends beyond the bar to give the Gauge greater support.

**Metric Measure.** Graduated to read to 1-50 m/m on one side.

**English and Metric Measure.** Graduated to read to 1-50 m/m on one side and to 1000ths of an inch on the other. All measurements outside only.



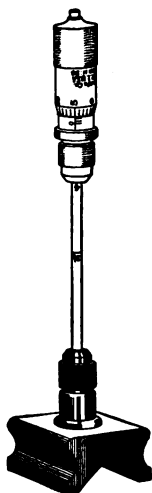
## Height Gauge Attachment, No. 598.

598



For use with Inside Micrometers, Nos. 260 and 261.

Price, \$1 75.



These cuts show a base designed for use in connection with the Inside Micrometers, thus making a reliable Height Gauge, also the method of using the same.

The measuring rod is inserted upwards through the under side of the base and the clamping fingers; and by turning the knurled nut, the rod is held firmly in an upright position. The micrometer is then adjusted and clamped to the upper end of the rod.

The base has a V-shaped groove in the bottom, which adapts the tool for use in cylindrical work.

# Vernier Depth Gauge, No. 600.

600

ENGLISH, METRIC, OR ENGLISH  
AND METRIC MEASURE.

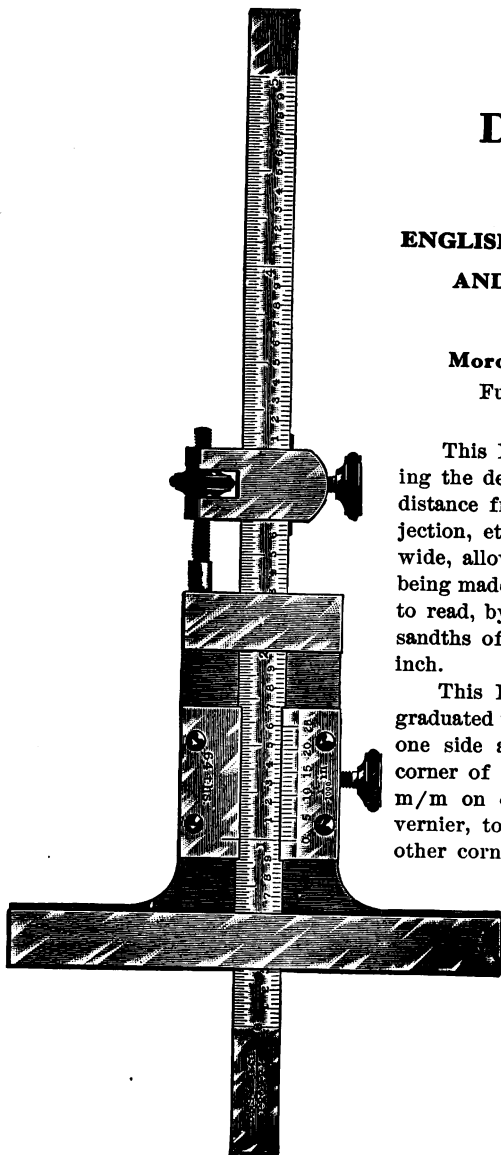
Price, \$11 00.

Morocco Case, \$1 00 extra.

Furnished in case unless  
otherwise ordered.

This Depth Gauge is used in obtaining the depth of holes, recesses in dies, distance from a plane surface to a projection, etc. The blade is 5" long, 1-4" wide, allows of measurements to 3 1-2" being made, and is graduated on the front to read, by means of a vernier, to thousandths of an inch, and to 64ths of an inch.

This Depth Gauge is also furnished graduated to read to 1-50th of a m/m on one side and to 1-2 m/m on the other corner of the same side; or 1-50th of a m/m on one side, and by means of a vernier, to 1-1000th of an inch on the other corner of the same side.



# Micrometer Depth Gauge, No. 605.

ENGLISH OR METRIC MEASURE.

2" Base.

Price, \$5 50. Morocco Case, \$0 50 extra.

4" Base.

Price, \$6 00. Morocco Case, \$0 75 extra.

4 1-2" Base.

Price, \$7 00. Morocco Case, \$2 00 extra.

Patented January 11, 1898.

The 2" and 4" base Micrometer Depth Gauges will measure all distances to 2 1-2" by .001".

The screw in each of these Gauges has a movement of 1-2". The graduations are of such a form and depth that the clamping fingers, at end of gauge, spring in, allowing the 1-2" adjustments of the rod to be quickly and positively made.

The base is about 7-16" thick, and, together with the point of the rod, is hardened.

These Depth Gauges are also made to measure all distances to 63 millimetres by hundredths of a millimetre.

The 4 1-2" base Gauge measures all distances to 12" by .001".

The screw has a movement of 1". The rod is graduated in inches. The graduations are of such a form and depth that the clamping fingers, at end of gauge, spring in, allowing the 1" adjustments of the rod to be quickly and positively made.

The base is about 9-16" thick, and, together with the point of the rod, is hardened.

This Gauge is regularly furnished with a bevel point rod as shown, but can be furnished with a flat point if desired.

**Metric Measure.** This Gauge is also made to measure all distances to 300 millimetres by hundredths of a millimetre.

605





# Universal Depth Gauge, No. 610.

ENGLISH MEASURE.

METRIC MEASURE.

Price, \$3 00.

610

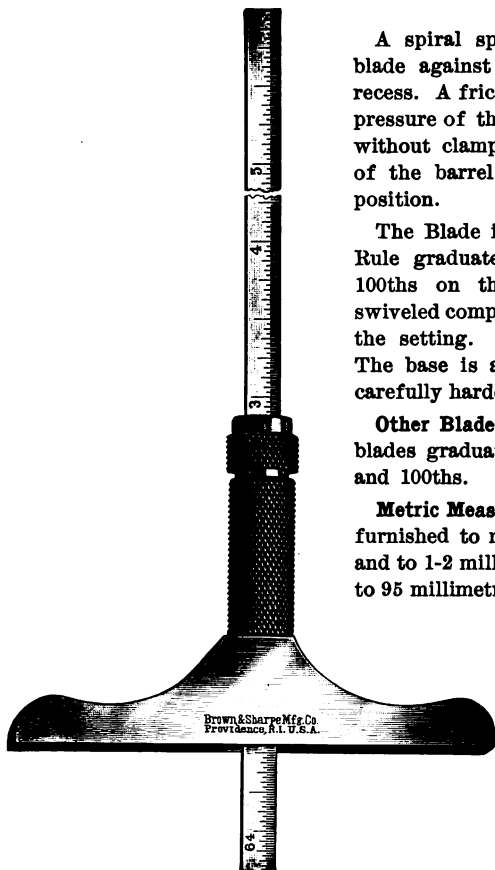
Patented June 21, 1904.

A spiral spring in the barrel forces the blade against the bottom of the hole or recess. A friction clutch, free to move under pressure of the spiral spring, holds the blade without clamping. A clamp nut at the top of the barrel clamps the blade securely in position.

The Blade is a narrow 6" Tempered Steel Rule graduated to 64ths on one side and 100ths on the other. The blade can be swiveled completely round without disturbing the setting. Measures to 3 1-8" in depth. The base is about 3" long, 7-16" wide and carefully hardened and ground.

**Other Blades.** We furnish, when desired, blades graduated to 32ds and 64ths or 50ths and 100ths.

**Metric Measure.** This Depth Gauge is also furnished to read to 1 millimetre on one side and to 1-2 millimetre on the other. Measures to 95 millimetres in depth.



## Spring Depth Gauges, No. 612.

**2" Base. Price, \$1 50.**

**4" Base. Price, \$2 00.**

**612**

**613**

The cut shows the head of the Depth Gauge together with a portion of the barrel and rod. It will measure to 3" in depth.

The base is about 7-16" wide and the rod about 1-8" in diameter.

A spiral spring in the barrel forces the rod against the bottom of the hole or recess to be measured and by use of the clamp screw the rod is securely locked in position.

The base and lower end of the rod are both hardened.

## Spring Depth Gauge, No. 613.

**WITH FRICTION.**

**3' Base. Price, \$2 25.**

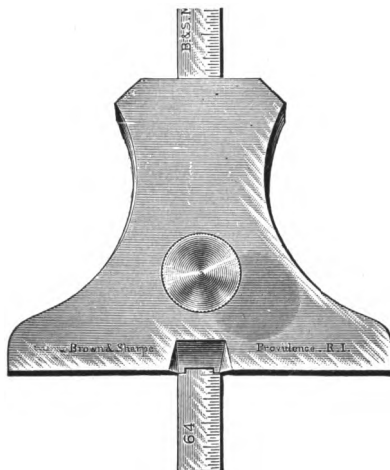
This Gauge differs from No. 612 only in that the rod is held by a friction clutch that is free to move under pressure of the spiral spring and enables approximate settings to be quickly made. Measures to 4" in depth.



## 6 Inch Rule Depth Gauge,

No. 615.

615



**ENGLISH OR METRIC MEASURE.**

**Price, \$1 25.**

The above is a full sized cut of the head and a portion of the blade of a 6" Rule Depth Gauge.

The head can be conveniently held. It is made of steel 1-8" thick, hardened.

The blade is a 6" narrow tempered steel rule.

The blade sent with the gauge is divided into 64ths and 100ths of inches.

Will furnish, if desired, blades divided into 32nds and 64ths, or 50ths and 100ths of inches.

This Depth Gauge is also furnished with a blade 15 c/m long, graduated on one corner to 1-2 m/m and on the other corner to 1 m/m.

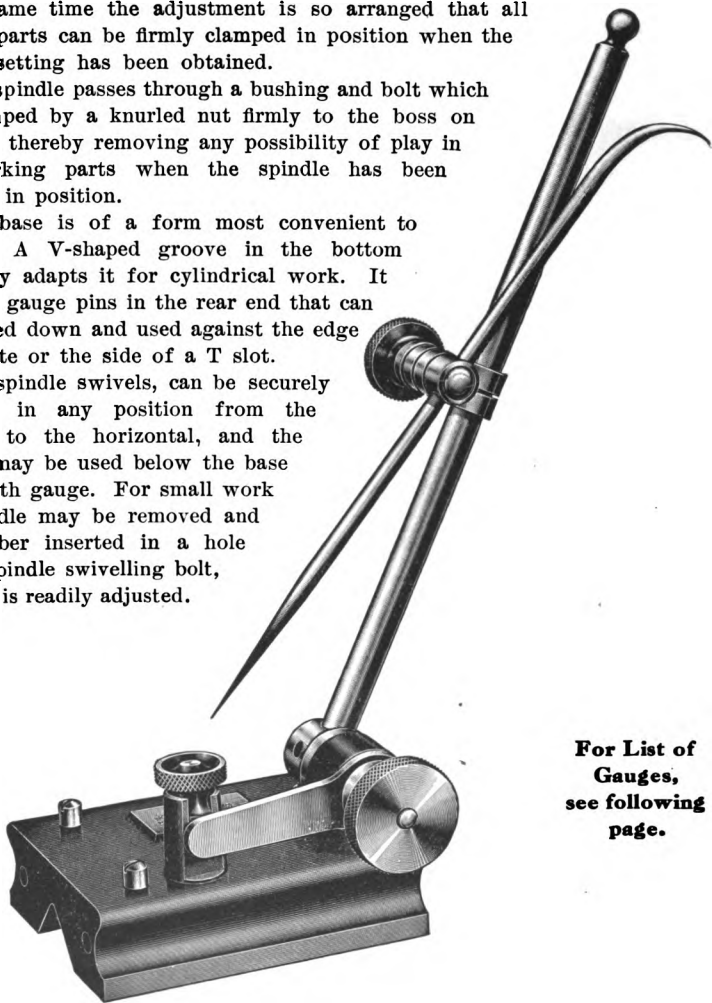
## Universal Surface Gauges.

This line of Surface Gauges has been designed so that a wide range of adjustments can be quickly obtained by means of the knurled adjusting screw. The maximum adjustment can be quickly obtained, and at the same time the adjustment is so arranged that all moving parts can be firmly clamped in position when the desired setting has been obtained.

The spindle passes through a bushing and bolt which are clamped by a knurled nut firmly to the boss on the base thereby removing any possibility of play in the working parts when the spindle has been clamped in position.

The base is of a form most convenient to handle. A V-shaped groove in the bottom especially adapts it for cylindrical work. It has two gauge pins in the rear end that can be pushed down and used against the edge of a plate or the side of a T slot.

The spindle swivels, can be securely clamped in any position from the vertical to the horizontal, and the scriber may be used below the base as a depth gauge. For small work the spindle may be removed and the scriber inserted in a hole in the spindle swivelling bolt, where it is readily adjusted.



**For List of  
Gauges,  
see following  
page.**

## Universal Surface Gauge, No. 620.

Price, with 4" Spindle, Base Not Hardened . . . . .	\$2 50	
Price, with 4" Spindle, Base Hardened . . . . .	3 00	620
Size of Base, 2 1-4" x 1 1-2".		621

## Universal Surface Gauge, No. 621.

622

Price, with 9" Spindle, Base Not Hardened . . . . .	\$2 50	
Price, with 9" and 12" Spindles, Base Not Hardened . . . . .	2 85	
Price, with 9" Spindle, Base Hardened . . . . .	3 50	
Price, with 9" and 12" Spindles, Base Hardened . . . . .	3 85	
Size of Base, 3 1-8" x 2 1-2".		

## Universal Surface Gauge, No. 622.

### Heavy Base.

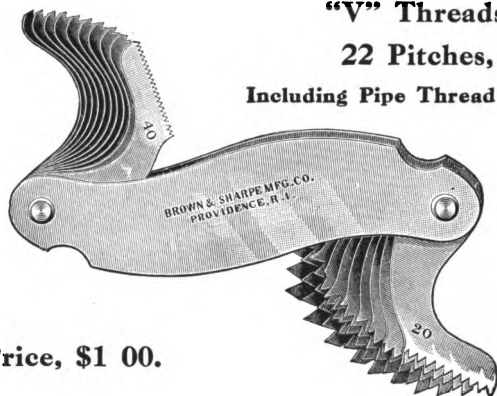
Price, with 12" Spindle, Base Not Hardened . . . . .	\$3 00	
Price, with 12" and 18" Spindles, Base Not Hardened . . . . .	3 50	
Price, with 12" Spindle, Base Hardened . . . . .	4 00	
Price, with 12" and 18" Spindles, Base Hardened . . . . .	4 50	
Size of Base, 4" x 3 3-8".		

## Screw Pitch Gauge, No. 630.

**"V" Threads.**

**22 Pitches,**

**Including Pipe Thread Pitches.**



**Price, \$1 00.**

This Screw Pitch Gauge is designed for the threads of nuts as well as of screws and contains the threads per inch: 9, 10, 11, 11 1-2, 12, 13, 14, 15, 16, 18 and 20 on one end and 22, 24, 26, 27, 28, 30, 32, 34, 36, 38 and 40 on the other end.

The arrangement of blades hinged on each end of the case enables any desired to be quickly placed in position for use.

There are 22 pitches, including pipe thread, threads per inch, 11 1-2 and 27. The 8 pitch can be determined by using the 16 pitch blade.

## Screw Pitch Gauge, No. 631.

**"V" THREADS.**

**24 Pitches. Price, \$1 25.**

This Screw Pitch Gauge is similar in design to the No. 630. It contains 24 blades with threads per inch: 4, 4 1-2, 5, 5 1-2, 6, 7, 8, 9, 10, 11, 11 1-2 and 12 on one end and 13, 14, 15, 16, 18, 20, 22, 24, 26, 27, 28 and 30 on the other.

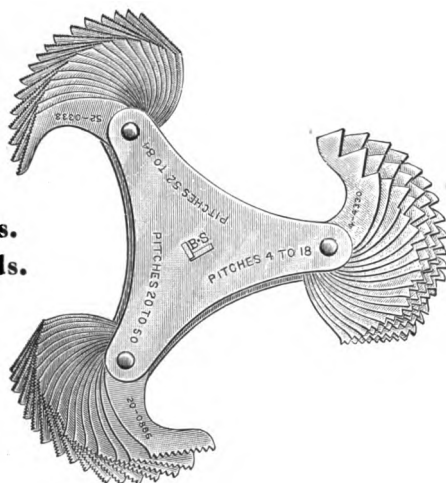
## Screw Pitch Gauge, No. 632.

**"V" THREADS.**

**30 Pitches. Price, \$1 50.**

This Screw Pitch Gauge is similar in design to the No. 630. It contains 30 blades with threads per inch: 4, 4 1-2, 5, 5 1-2, 6, 7, 8, 9, 10, 11, 11 1-2, 12, 13, 14 and 15 on one end and 16, 18, 20, 22, 24, 26, 27, 28, 30, 32, 34, 36, 38, 40 and 42 on the other.

## Screw Pitch Gauge, No. 633.



**51 Pitches.**  
**"V" Threads.**

**633**  
**634**  
**Price, \$2 25.**  
**635**

The triangular form of the frame of this Screw Pitch Gauge permits a compact housing of 51 blades for threads of nuts as well as of screws.

Threads per inch: 4, 4 1-2, 5, 5 1-2, 6, 7, 8, 9, 10, 11, 11 1-2, 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 27, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82 and 84.

## Screw Pitch Gauge, No. 634.

**For Electricians and Automobile Manufacturers.**

**"V" THREADS.**

**22 Pitches. Price, \$1 00.**

This Gauge is similar in design to the No. 630 shown on preceding page, and is designed especially to meet the requirements of automobile manufacturers, electricians and others using screws with fine V threads.

The Gauge contains 22 blades with threads per inch: 32, 34, 36, 38, 40, 42, 44, 46, 48, 50 and 52 on one end, and 54, 56, 58, 60, 62, 64, 66, 68, 70, 72 and 74 on the other.

## Screw Pitch Gauge, No. 635.

**U. S. STANDARD THREAD.**

**25 Pitches. Price, \$1 50.**

This Gauge is similar in design to No. 630. It contains 25 blades, with threads per inch: 2 1-4, 2 3-8, 2 1-2, 2 5-8, 2 3-4, 2 7-8, 3, 3 1-4, 3 1-2, 4, 4 1-2 and 5 on one end, and 5 1-2, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 18 and 20 on the other. It also contains a blade with a gauge for grinding thread tools.

## Screw Pitch Gauge, No. 636.

Systeme International.

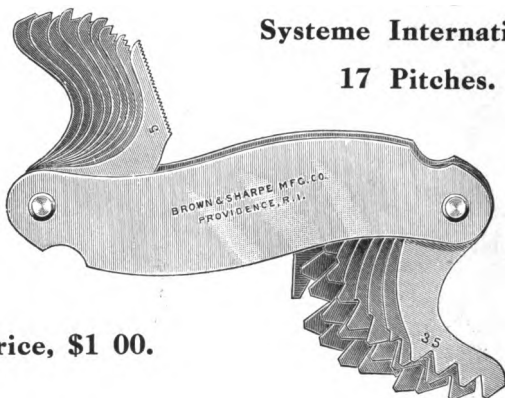
17 Pitches.

636

637

638

Price, \$1 00.



This Gauge affords means for determining quickly the pitch for screws, nuts, bolts, etc., and is made after the French system of the Society of Encouragement for National Industry. It can be used for inside as well as outside threads. The Gauge contains blades for the following pitches: 1-2, 3-4, 1, 1 1-4, 1 1-2, 1 3-4, 2, 2 1-2, 3, 3 1-2, 4, 4 1-2, 5, 5 1-2, 6, 6 1-2 and 7 millimetres. It also contains a blade with a gauge for grinding thread tools.

## Screw Pitch Gauge, No. 637.

Whitworth Standard.

24 Pitches.

Price, \$1 25.

This Gauge is similar in design to the No. 630 Screw Pitch Gauge, contains 24 blades, with threads per inch: 4, 4 1-2, 5, 6, 7, 8, 9, 10, 11, 12, 14 and 16 on one end; 18, 19, 20, 22, 24, 25, 26, 28, 30, 32, 40 and 48 on the other.

## Screw Pitch Gauge, No. 638.

Society of Automobile Engineers Standard.

7 Pitches.

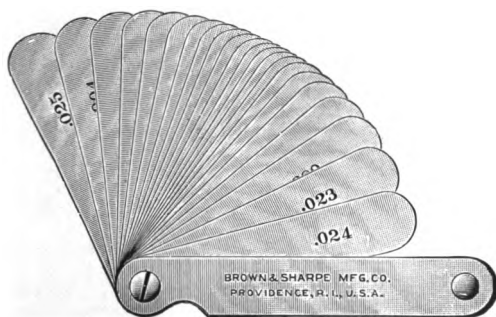
Price, \$1 25.

This Gauge is similar in design to the No. 630 Screw Pitch Gauge, and contains blades for the following pitches: 12, 14, 16, 18, 20, 24 and 28. It also contains a blade with a gauge for grinding thread tools



# Thickness Gauges, Nos. 640, 641, 642 and 643.

ENGLISH OR METRIC MEASURE.



No. 640, English.

Price, \$1 50.

This Gauge consists of a set of 22 steel blades, varying in thickness from .004 to .025 of an inch, by thousandths. These blades may be used singly or in combination, as may be desired. Plain figures, easily read, indicate the thickness of each blade.

No. 641, Metric.

Price, \$1 50.

This Gauge is of the same design as the No. 640, and consists of a set of 14 steel blades of the following thicknesses: .05, .06, .07, .08, .09, .10, .15, .20, .25, .30, .40, .50, .75 and 1 m/m.



No. 642, English.

Price, \$1 00.

This Gauge is similar in design to No. 640, and consists of a set of nine steel blades, .0015, .002, .003, .004, .006, .008, .010, .012 and .015 of an inch in thickness.

No. 643, Metric.

Price, \$1 00.

This Gauge is of the same design as the No. 640, and consists of a set of nine steel blades of the following thicknesses: .04, .05, .08, .10, .15, .20, .25, .30 and .35 m/m.

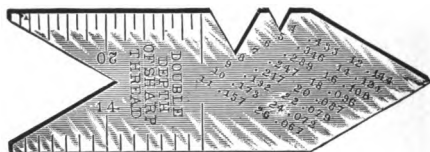
# Centre Gauges, Nos. 650, 651 and 652.

## AND GAUGES FOR

### Grinding and Setting Screw Cutting Tools,

**650** With Table for Determining the Size of Tap Drills for 60° V Threads.

**651**



Full size.

**652**

U. S. Standard, 60°.

No. 650, Price, 25 cents. Tempered, Price 35 cents.

Whitworth or English Standard, 55°.

No. 651, Price, 25 cents. Tempered, Price, 35 cents.

Metric, 60°.

No. 652, Price, 25 cents. Tempered, Price, 35 cents.

The angles used on these gauges are 60 degrees for the U. S. Standard and Metric Gauges and 55 degrees for the Whitworth or English Standard. The four divisions, 14, 20, 24 and 32 parts to the inch, are useful in measuring the number of threads to the inch. The following parts to the inch can be determined by them, viz.: 2, 3, 4, 5, 6, 7, 8, 10, 12, 14, 16, 20, 24, 28 and 32.

The metric gauge is graduated to read to millimetres and half millimetres. When so graduated the table for determining the size of tap drills is omitted.

The table on the gauge (see full size cut) is used for determining the size of tap drills for sharp 60° V threads, and shows in thousandths of an inch the double depth of thread of tap and screws of the pitches most commonly used. This table is made up by dividing 1.732, the double depth of thread of a screw that is 1 pitch, by the number of threads of the various pitches shown.

As the double depth of thread represents the difference in the diameter of a tap and a tap drill, to obtain the diameter of a tap drill of any desired pitch it is only necessary to subtract the decimal showing the double depth of thread of that pitch from the diameter of the tap. For example, if the tap is 4 pitch, sharp V thread, and one inch diameter, subtract .433, the decimal showing the double depth of thread of this pitch in the table, from one, and the result, .567 of an inch, is the size of the tap drill, which would allow a sharp thread in the hole. Allowance is to be made for the extent to which it is desired the threads should be flattened. It is not practicable to tap a perfectly sharp thread.

# Standard End Measuring Rods, No. 655.

## With Spherical Ends.

655

The Standard End Measuring Rods are made of steel, hardened on the ends and accurately ground, so that the ends are sections of true spheres having diameters equal to those of the length of the rods. These Rods can be used for measuring rings, cylinders, etc., setting calipers, comparing gauges or work of like character and are especially useful for measuring parallel surfaces.

The Rods from 3" to 6" are 3-8" in diameter and larger than 6", 1-2" in diameter.

## No. 655, English.

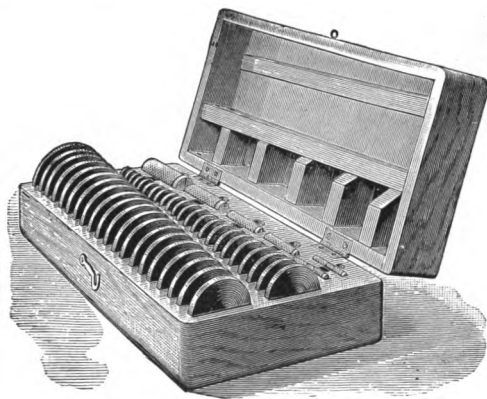
Length.	Price.	Length.	Price.
3"	\$1 40	10"	\$2 80
4	1 60	11	3 00
5	1 80	12	3 20
6	2 00	13	3 40
7	2 20	14	3 60
8	2 40	15	3 80
9	2 60	16	4 00

## No. 656, Metric.

Length.	Price.	Length.	Price.
75 m/m	\$1 40	250 m/m	\$2 80
100	1 60	275	3 00
125	1 80	300	3 20
150	2 00	325	3 40
175	2 20	350	3 60
200	2 40	375	3 80
225	2 60	400	4 00

All intermediate sizes furnished at the price of the size next larger given in the list.

## Standard Reference Disks.



**Price per Set, \$50 00.**

When a Gauge or Caliper has been long in use, the question arises whether constant use has not impaired its accuracy.

The **Standard Reference Disks** are for reference sizes in shop practice, such as testing measuring tools, setting calipers, etc. They are used generally without handles. With handles, however, they may be used in place of **Standard Cylindrical Gauges**, but are not recommended for constant use as substitutes for them, being designed to serve principally as reference, not as working gauges. These **Disks** are hardened, ground and accurately lapped to size; the widths of the measuring surfaces are suitably proportioned to the size of the **Disk**. They are furnished singly of any desired size, but are usually furnished in sets, consisting of 45 **Disks** from 1-4 inch to 3 inches, varying by 16ths, including 6 handles. Each complete set is neatly arranged in a substantial case.

**Metric Disks** are also carried in stock, in sizes from 6 m/m to 50 m/m, varying by 2 m/m; and 55 m/m to 100 m/m, varying by 5 m/m.

**Special Sizes** made to order.

# Standard Reference Disks.

## No. 657 English.

Size.	Price.	Size.	Price.	Size.	Price.
*1-4"	\$1 50	1 3-16"	\$1 10	2 1-8"	\$1 65
*5-16	1 50	1 1-4	1 10	2 3-16	1 65
3-8	90	1 5-16	1 25	2 1-4	1 65
7-16	90	1 3-8	1 25	2 5-16	1 80
1-2	1 00	1 7-16	1 25	2 3-8	1 80
9-16	1 00	1 1-2	1 25	2 7-16	1 80
5-8	1 00	1 9-16	1 40	2 1-2	1 80
11-16	1 00	1 5-8	1 40	2 9-16	1 95
3-4	1 05	1 11-16	1 40	2 5-8	1 95
13-16	1 05	1 3-4	1 40	2 11-16	1 95
7-8	1 05	1 13-16	1 55	2 3-4	2 10
15-16	1 05	1 7-8	1 55	2 13-16	2 10
1	1 10	1 15-16	1 55	2 7-8	2 25
1 1-16	1 10	2	1 55	2 15-16	2 25
1 1-8	1 10	2 1-16	1 65	3	2 25

## No. 658 Metric.

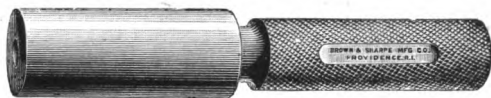
Size.	Price.	Size.	Price.	Size.	Price.
*6 m/m	\$1 50	28 m/m	\$1 10	50 m/m	\$1 55
*8	1 50	30	1 10	55	1 65
10	90	32	1 10	60	1 80
12	1 00	34	1 25	65	1 95
14	1 00	36	1 25	70	2 10
16	1 00	38	1 25	75	2 25
18	1 00	40	1 40	80	2 50
20	1 05	42	1 40	85	2 50
22	1 05	44	1 40	90	2 50
24	1 05	46	1 55	95	2 75
26	1 10	48	1 55	100	2 75

\*These sizes are furnished with handles.

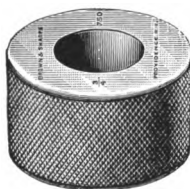
## PRICE OF HANDLES.

For 3-8" to 9-16" or 10 to 14 m/m Disks . . . . .	\$0 65
For 5-8" to 1 1-16" or 16 to 26 m/m Disks . . . . .	75
For 1 1-8" to 1 3-4" or 28 to 44 m/m Disks . . . . .	80
For 1 13-16" to 3" or 46 to 75 m/m Disks . . . . .	90
For 80 m/m to 100 m/m Disks . . . . .	90

## Standard Internal and External Cylindrical Gauges.



INTERNAL.



EXTERNAL.

These gauges have exceptionally large measuring surfaces and are recommended for the most accurate work. Each gauge is plainly stamped with its size, both in decimals and common fractions; and a rigid inspection is exacted before gauges are prepared for shipment.

**The Internal Gauges or "Plugs"** are convenient for ordinary machine work, as calipers can be set and dimensions transferred more accurately than from a rule; and, for measuring work internally, they can be employed directly without the use of calipers.

The large sizes are unusually light in proportion to their size. They consist of a hardened steel ring on an aluminum center; and while this construction makes the gauges very light and convenient, it does not in any way impair their accuracy.

**The External Gauges or "Rings"** can be used direct for measuring shafts, spindles and work of a similar class.

These gauges are furnished singly of any desired size. They are also carried in stock, arranged in sets containing sizes from 1-4 inch to 2 inches, varying by 16ths. Price per Set, \$325 00.

**Metric Gauges** are carried in stock in sizes from 5 m/m to 50 m/m, varying by 1 m/m; and from 55 m/m to 100 m/m, varying by 5 m/m.

Each complete set is neatly arranged in a substantial case.

For Lists of both Internal and External Cylindrical Gauges, see two following pages.

# Standard Internal Cylindrical Gauges.

## No. 660 English.

Size.	Price.	Size.	Price.	Size.	Price.	
1-8"	\$3 00	1 1-8"	\$4 30	2 1-8"	\$7 15	660
3-16	3 00	1 3-16	4 40	2 3-16	7 30	
1-4	3 00	1 1-4	4 50	2 1-4	7 45	
5-16	3 00	1 5-16	4 65	2 5-16	7 60	
3-8	3 10	1 3-8	4 80	2 3-8	7 85	661
7-16	3 20	1 7-16	4 95	2 7-16	8 10	
1-2	3 30	1 1-2	5 10	2 1-2	8 25	
9-16	3 40	1 9-16	5 25	2 9-16	8 40	
5-8	3 50	1 5-8	5 40	2 5-8	8 55	
11-16	3 60	1 11-16	5 55	2 11-16	8 70	
3-4	3 70	1 3-4	5 70	2 3-4	8 85	
13-16	3 80	1 13-16	5 85	2 13-16	9 00	
7-8	3 90	1 7-8	6 00	2 7-8	9 15	
15-16	4 00	1 15-16	6 15	2 15-16	9 30	
1	4 10	2	6 30	3	9 45	
1 1-16	4 20	2 1-16	7 00			

## No. 661 Metric.

Size.	Price.	Size.	Price.	Size.	Price.
5 m/m	\$3 00	29 m/m	\$4 30	53 m/m	\$7 00
6	3 00	30	4 40	54	7 15
7	3 00	31	4 50	55	7 30
8	3 00	32	4 50	56	7 30
9	3 10	33	4 65	57	7 45
10	3 10	34	4 80	58	7 60
11	3 20	35	4 80	59	7 60
12	3 30	36	4 95	60	7 85
13	3 30	37	4 95	61	8 10
14	3 40	38	5 10	62	8 10
15	3 50	39	5 25	63	8 25
16	3 50	40	5 25	64	8 25
17	3 60	41	5 40	65	8 40
18	3 60	42	5 55	66	8 55
19	3 70	43	5 55	67	8 55
20	3 80	44	5 70	68	8 70
21	3 80	45	5 70	69	8 85
22	3 90	46	5 85	70	8 85
23	4 00	47	6 00	71	9 00
24	4 00	48	6 00	72	9 00
25	4 10	49	6 15	73	9 15
26	4 20	50	6 30	74	9 30
27	4 20	51	6 30	75	9 30
28	4 30	52	7 00		

# Standard External Cylindrical Gauges.

## No. 662 English.

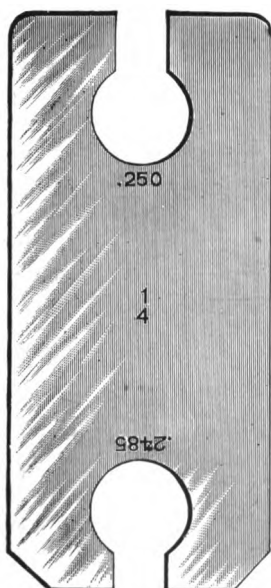
	Size.	Price.		Size.	Price.		Size.	Price.
662	1-8"	\$4 45		1 1-8"	\$6 75		2 1-8"	\$11 25
	3-16	4 45		1 3-16	7 00		2 3-16	11 50
	1-4	4 45		1 1-4	7 25		2 1-4	11 75
	5-16	4 60		1 5-16	7 50		2 5-16	12 00
663	3-8	4 75		1 3-8	7 75		2 3-8	12 25
	7-16	4 90		1 7-16	8 00		2 7-16	12 50
	1-2	5 05		1 1-2	8 25		2 1-2	12 75
	9-16	5 20		1 9-16	8 50		2 9-16	13 00
	5-8	5 35		1 5-8	8 75		2 5-8	13 25
	11-16	5 50		1 11-16	9 00		2 11-16	13 50
	3-4	5 65		1 3-4	9 25		2 3-4	13 75
	13-16	5 80		1 13-16	9 50		2 13-16	14 00
	7-8	5 95		1 7-8	9 75		2 7-8	14 25
	15-16	6 10		1 15-16	10 00		2 15-16	14 50
	1	6 25		2	10 25		3	14 75
	1 1-16	6 50		2 1-16	11 00			

## No. 663 Metric.

	Size.	Price.		Size.	Price.		Size.	Price.
	5 m/m	\$4 45		29 m/m	\$6 75		53 m/m	\$11 00
	6	4 45		30	7 00		54	11 25
	7	4 60		31	7 25		55	11 50
	8	4 60		32	7 25		56	11 50
	9	4 75		33	7 50		57	11 75
	10	4 75		34	7 75		58	12 00
	11	4 90		35	7 75		59	12 00
	12	5 05		36	8 00		60	12 25
	13	5 05		37	8 00		61	12 50
	14	5 20		38	8 25		62	12 50
	15	5 35		39	8 50		63	12 75
	16	5 35		40	8 50		64	12 75
	17	5 50		41	8 75		65	13 00
	18	5 50		42	9 00		66	13 25
	19	5 65		43	9 00		67	13 25
	20	5 80		44	9 25		68	13 50
	21	5 80		45	9 25		69	13 75
	22	5 95		46	9 50		70	13 75
	23	6 10		47	9 75		71	14 00
	24	6 10		48	9 75		72	14 00
	25	6 25		49	10 00		73	14 25
	26	6 50		50	10 25		74	14 50
	27	6 50		51	10 25		75	14 50
	28	6 75		52	11 00			



## Limit Gauges.



**EXTERNAL**



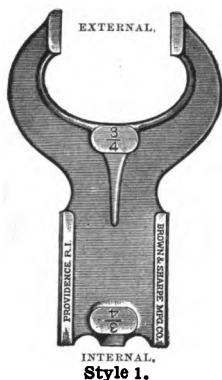
**INTERNAL**

The advantages derived from the use of Limit Gauges are that the time consumed in testing and gauging is reduced to a minimum and the accurate duplication of parts is insured. The two ends are of different shape, thus furnishing means of identifying the larger end from the smaller without reference to the size stamped on the gauge.

In addition to their value for finishing sizes they are of great advantage in roughing work for finishing, the same amount of stock being left on each piece, making it much easier to finish them to size.

Prices are quoted on Limit or Special Gauges of all descriptions, when specifications, drawings or samples of work are sent. The dimensions required at each end of the gauge must be plainly stated in thousandths or fractions of thousandths of an inch.

## Standard Caliper Gauges.



INTERNAL.  
Style 1.



Style 3.



Style 2.

The Standard Caliper Gauges are carefully hardened and ground and accurately lapped to size. By their use mistakes in the setting of calipers and variations in measurements by different workmen will be in a great measure avoided. Their form gives lightness and strength, making them preferable to plugs and rings for frequent use. The measuring surfaces are amply large to insure accurate measurements and the maintenance of Gauge sizes. As furnishing convenient and reliable standard sizes for every-day use in the workshop, they are of great advantage, and their use will contribute to uniformity in the production of the working parts of machinery.

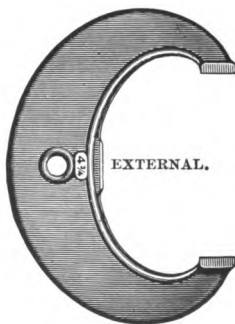
These Gauges are furnished with both ends finished, one end for internal and the other for external measurements, in sizes to three inches. They are also furnished in these sizes with one end only finished, either for internal or for external measurements, and provided with handles.

These gauges are also furnished in sets, comprising sizes from 1-4 inch to 2 1-2 inches inclusive, varying by 16ths to 2 inch and above 2 inches by 8ths. Each full set is neatly arranged in a substantial case. Price per Set, \$100 00.

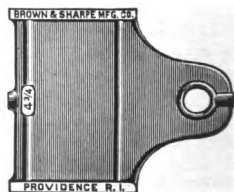
## Standard Caliper Gauges.

For convenience in handling, the Standard Caliper Gauges in the larger sizes are made as shown in cut.

For List of Caliper Gauges, see following pages.



Style 4.



INTERNAL.  
Style 5.

# Standard Caliper Gauges.

**BOTH ENDS FINISHED.**

## No. 665 English—Style 1.

See page 138.

Size.	Both Ends Finished.	Size.	Both Ends Finished.	Size.	Both Ends Finished.	
1-4"	\$2 50	1 3-16"	\$2 85	2 1-8"	\$4 00	<b>665</b>
5-16	2 50	1 1-4	2 90	2 3-16	4 10	
3-8	2 50	1 5-16	2 95	2 1-4	4 20	
7-16	2 50	1 3-8	3 00	2 5-16	4 30	
1-2	2 50	1 7-16	3 05	2 3-8	4 40	<b>666</b>
9-16	2 50	1 1-2	3 10	2 7-16	4 50	
5-8	2 50	1 9-16	3 20	2 1-2	4 60	
11-16	2 50	1 5-8	3 30	2 9-16	5 00	
3-4	2 50	1 11-16	3 40	2 5-8	5 25	
13-16	2 55	1 3-4	3 50	2 11-16	5 50	
7-8	2 60	1 13-16	3 60	2 3-4	5 50	
15-16	2 65	1 7-8	3 70	2 13-16	6 00	
1	2 70	1 15-16	3 80	2 7-8	6 00	
1 1-16	2 75	2	3 90	2 15-16	6 00	
1 1-8	2 80	2 1-16	3 95	3	6 50	

## No. 666 Metric.

Size.	Both Ends Finished.	Size.	Both Ends Finished.	Size.	Both Ends Finished.
5 m/m	\$2 50	29 m/m	\$2 85	53 m/m	\$3 95
6	2 50	30	2 85	54	4 00
7	2 50	31	2 90	55	4 10
8	2 50	32	2 90	56	4 10
9	2 50	33	2 95	57	4 20
10	2 50	34	3 00	58	4 30
11	2 50	35	3 00	59	4 30
12	2 50	36	3 05	60	4 40
13	2 50	37	3 05	61	4 50
14	2 50	38	3 10	62	4 50
15	2 50	39	3 20	63	4 60
16	2 50	40	3 20	64	4 60
17	2 50	41	3 30	65	5 00
18	2 50	42	3 40	66	5 25
19	2 50	43	3 40	67	5 25
20	2 55	44	3 50	68	5 50
21	2 55	45	3 50	69	5 50
22	2 60	46	3 60	70	5 50
23	2 65	47	3 70	71	6 00
24	2 65	48	3 70	72	6 00
25	2 70	49	3 80	73	6 00
26	2 75	50	3 90	74	6 00
27	2 75	51	3 90	75	6 00
28	2 80	52	3 95		

# Standard Caliper Gauges.

INTERNAL WITH HANDLES.

## No. 667 English.

Style 3 up to and including 2 15-16" or 74 m/m; the rest are Style 5. See page 138

	Size.	Internal.	Size.	Internal.	Size.	Internal.
667	1-4"	\$1 40	1 3-8"	\$1 65	2 1-2"	\$2 50
	5-16	1 40	1 7-16	1 65	2 9-16	2 80
	3-8	1 40	1 1-2	1 70	2 5-8	2 90
	7-16	1 40	1 9-16	1 75	2 11-16	3 00
668	1-2	1 40	1 5-8	1 80	2 3-4	3 00
	9-16	1 40	1 11-16	1 90	2 13-16	3 30
	5-8	1 40	1 3-4	2 00	2 7-8	3 30
	11-16	1 40	1 13-16	2 00	2 15-16	3 30
	3-4	1 45	1 7-8	2 10	3 to 3 1-4	3 30
	13-16	1 45	1 15-16	2 10	3 5-16 to 3 1-2	3 50
	7-8	1 45	2	2 20	3 9-16 to 3 3-4	3 75
	15-16	1 45	2 1-16	2 20	3 13-16 to 4	4 00
	1	1 50	2 1-8	2 20	4 1-16 to 5	4 25
	1 1-16	1 50	2 3-16	2 30	5 1-16 to 6	4 50
	1 1-8	1 55	2 1-4	2 30	6 1-16 to 7	4 75
	1 3-16	1 55	2 5-16	2 30	7 1-16 to 8	5 00
	1 1-4	1 60	2 3-8	2 40		
	1 5-16	1 60	2 7-16	2 40		

## No. 668 Metric.

Size in m/m.	In-ternal.	Size in m/m.	In-ternal.	Size in m/m.	In-ternal.	Size in m/m.	In-ternal.	Size in m/m.	In-ternal.
5	\$1 40	29	\$1 55	53	\$2 20	77	\$3 30	105	\$4 25
6	1 40	30	1 55	54	2 30	78	3 30	110	4 25
7	1 40	31	1 60	55	2 30	79	3 30	115	4 25
8	1 40	32	1 60	56	2 30	80	3 30	120	4 25
9	1 40	33	1 60	57	2 30	81	3 30	125	4 25
10	1 40	34	1 65	58	2 30	82	3 30	130	4 50
11	1 40	35	1 65	59	2 40	83	3 50	135	4 50
12	1 40	36	1 65	60	2 40	84	3 50	140	4 50
13	1 40	37	1 70	61	2 40	85	3 50	145	4 50
14	1 40	38	1 70	62	2 50	86	3 50	150	4 50
15	1 40	39	1 75	63	2 50	87	3 50	155	4 75
16	1 40	40	1 80	64	2 80	88	3 50	160	4 75
17	1 40	41	1 80	65	2 80	89	3 75	165	4 75
18	1 45	42	1 90	66	2 90	90	3 75	170	4 75
19	1 45	43	2 00	67	3 00	91	3 75	175	4 75
20	1 45	44	2 00	68	3 00	92	3 75	180	5 00
21	1 45	45	2 00	69	3 00	93	3 75	185	5 00
22	1 45	46	2 00	70	3 30	94	3 75	190	5 00
23	1 45	47	2 10	71	3 30	95	3 75	195	5 00
24	1 50	48	2 10	72	3 30	96	4 00	200	5 00
25	1 50	49	2 10	73	3 30	97	4 00		
26	1 50	50	2 20	74	3 30	98	4 00		
27	1 55	51	2 20	75	3 30	99	4 00		
28	1 55	52	2 20	76	3 30	100	4 00		

# Standard Caliper Gauges.

## EXTERNAL

### No. 669 English.

Style 2 up to and including 2" or 50 m/m; the rest are Style 4. See page 138.

Size.	External.	Size.	External.	Size.	External.
1-4"	\$1 40	1 7-16"	\$1 65	2 5-8"	\$2 90
5-16	1 40	1 1-2	1 70	2 11-16	3 00
3-8	1 40	1 9-16	1 75	2 3-4	3 00
7-16	1 40	1 5-8	1 80	2 13-16	3 30
1-2	1 40	1 11-16	1 90	2 7-8	3 30
9-16	1 40	1 3-4	2 00	2 15-16	3 30
5-8	1 40	1 13-16	2 00	3 to 3 1-4	3 30
11-16	1 40	1 7-8	2 10	3 5-16 to 3 1-2	3 50
3-4	1 45	1 15-16	2 10	3 9-16 to 3 3-4	3 75
13-16	1 45	2	2 20	3 13-16 to 4	4 00
7-8	1 45	2 1-16	2 20	4 1-16 to 5	4 25
15-16	1 45	2 1-8	2 20	5 1-16 to 6	4 50
1	1 50	2 3-16	2 30	6 1-16 to 7	4 75
1 1-16	1 50	2 1-4	2 30	7 1-16 to 8	5 00
1 1-8	1 55	2 5-16	2 30	8 1-16 to 9	5 65
1 3-16	1 55	2 3-8	2 40	9 1-16 to 10	6 25
1 1-4	1 60	2 7-16	2 40	10 1-16 to 11	7 00
1 5-16	1 60	2 1-2	2 50	11 1-16 to 12	8 00
1 3-8	1 65	2 9-16	2 80		

### No. 670 Metric.

Size in m/m.	Ex-ternal.	Size in m/m.	Ex-ternal.	Size in m/m.	Ex-ternal.	Size in m/m.	Ex-ternal.	Size in m/m.	Ex-ternal.	Size in m/m.	Ex-ternal.
5	\$1 40	28	\$1 55	51	\$2 20	74	\$3 30	97	\$4 00	200	\$5 00
6	1 40	29	1 55	52	2 20	75	3 30	98	4 00	205	5 65
7	1 40	30	1 55	53	2 20	76	3 30	99	4 00	210	5 65
8	1 40	31	1 60	54	2 30	77	3 30	100	4 00	215	5 65
9	1 40	32	1 60	55	2 30	78	3 30	105	4 25	220	5 65
10	1 40	33	1 60	56	2 30	79	3 30	110	4 25	225	5 65
11	1 40	34	1 65	57	2 30	80	3 30	115	4 25	230	6 25
12	1 40	35	1 65	58	2 30	81	3 30	120	4 25	235	6 25
13	1 40	36	1 65	59	2 40	82	3 30	125	4 25	240	6 25
14	1 40	37	1 70	60	2 40	83	3 50	130	4 50	245	6 25
15	1 40	38	1 70	61	2 40	84	3 50	135	4 50	250	6 25
16	1 40	39	1 75	62	2 50	85	3 50	140	4 50	255	7 00
17	1 40	40	1 80	63	2 50	86	3 50	145	4 50	260	7 00
18	1 45	41	1 80	64	2 80	87	3 50	150	4 50	265	7 00
19	1 45	42	1 90	65	2 80	88	3 50	155	4 75	270	7 00
20	1 45	43	2 00	66	2 90	89	3 75	160	4 75	275	7 00
21	1 45	44	2 00	67	3 00	90	3 75	165	4 75	280	8 00
22	1 45	45	2 00	68	3 00	91	3 75	170	4 75	285	8 00
23	1 45	46	2 00	69	3 00	92	3 75	175	4 75	290	8 00
24	1 50	47	2 10	70	3 30	93	3 75	180	5 00	295	8 00
25	1 50	48	2 10	71	3 30	94	3 75	185	5 00	300	8 00
26	1 50	49	2 10	72	3 30	95	3 75	190	5 00		
27	1 55	50	2 20	73	3 30	96	4 00	195	5 00		

# Sizes of Numbers

## of the United States Standard Gauge

### For Sheet and Plate Iron and Steel.

#### An Act

#### Establishing a Standard Gauge for Sheet and Plate Iron and Steel

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled :*

That for the purpose of securing uniformity the following is established as the only gauge for sheet and plate iron and steel in the United States of America, namely :

Number of Gauge.	Approximate Thickness in Fractions of an Inch.	Approximate Thickness in Decimal Parts of an Inch.	Weight per Square Foot in Ounces Avordupois.	Weight per Square Foot in Pounds Avordupois.
0000000	1-2	.5	320	20.00
000000	15-32	.46875	300	18.75
00000	7-16	.4375	280	17.50
0000	13-32	.40625	260	16.25
000	3-8	.375	240	15.00
00	11-32	.34375	220	13.75
0	5-16	.3125	200	12.50
1	9-32	.28125	180	11.25
2	17-64	.265625	170	10.625
3	1-4	.25	160	10.00
4	15-64	.234375	150	9.375
5	7-32	.21875	140	8.75
6	13-64	.203125	130	8.125
7	3-16	.1875	120	7.5
8	11-64	.171875	110	6.875
9	5-32	.15625	100	6.25
10	9-64	.140625	90	5.625
11	1-8	.125	80	5.00
12	7-64	.109375	70	4.375
13	3-32	.09375	60	3.75
14	5-64	.078125	50	3.125
15	9-128	.0703125	45	2.8125

List continued on next page.

# SIZES OF NUMBERS

## OF THE UNITED STATES STANDARD GAUGE

### FOR SHEET AND PLATE IRON AND STEEL.

(Continued.)

Number of Gauge.	Approximate Thickness in Fractions of an Inch.	Approximate Thickness in Decimal Parts of an Inch.	Weight per Square Foot in Ounces Avoirdupois.	Weight per Square Foot in Pounds Avoirdupois.
16	1-16	.0625	40	2.5
17	9-160	.05625	36	2.25
18	1-20	.05	32	2.
19	7-160	.04375	28	1.75
20	3-80	.0375	24	1.50
21	11-320	.034375	22	1.375
22	1-32	.03125	20	1.25
23	9-320	.028125	18	1.25
24	1-40	.025	16	1.
25	7-320	.021875	14	.875
26	3-160	.01875	12	.75
27	11-640	.0171875	11	.6875
28	1-64	.015625	10	.625
29	9-640	.0140625	9	.5625
30	1-80	.0125	8	.5
31	7-640	.0109375	7	.4375
32	13-1280	.01015625	6 1-2	.40625
33	3-320	.009375	6	.375
34	11-1280	.00859375	5 1-2	.34375
35	5-640	.0078125	5	.3125
36	9-1280	.00703125	4 1-2	.28125
37	17-2560	.006640625	4 1-4	.265625
38	1-160	.00625	4	.25

And on and after July first, eighteen hundred and ninety-three, the same and no other shall be used in determining duties and taxes levied by the United States of America on sheet and plate iron and steel. But this act shall not be construed to increase duties upon any articles which may be imported.

SEC. 3. That in the practical use and application of the standard gauge hereby established a variation of two and one-half per cent. either way may be allowed.

Approved March 3, 1893.

# Different Standards for Wire Gauges in use in the United States.

Dimensions of Sizes in Decimal Parts of an Inch.

Number of Wire Gauge.	American, or Brown & Sharpe.	Birmingham, or Stubbs' Iron Wire	Washburn & Moen, Worcester Mass.	W. & M. Steel Music Wire.	New American S. & W. Co.'s Music Wire Gage	Imperial Wire Gauge.	Stubbs' Steel Wire.	U. S. Standard Gauge for Sheet and Plate Iron and Steel.	Number of Wire Gauge.
00000000	. . . .	. .	. .	.0083	. .	. .	. .	. . . .	00000000
0000000	. . . .	. .	. .	.0087	. .	. .	. .	. . . .	0000000
000000	. . . .	. .	. .	.0095	.004	.464	. .	.46875	000000
00000	. . . .	. .	. .	.010	.005	.432	. .	.4375	00000
0000	.460	.454	.3938	.011	.006	.400	. .	.40625	0000
000	.40964	.425	.3625	.012	.007	.372	. .	.375	000
00	.3648	.380	.3310	.0133	.008	.348	. .	.34375	00
0	.32486	.340	.3065	.0144	.009	.324	. .	.3125	0
1	.2893	.300	.2830	.0156	.010	.300	.227	.28125	1
2	.25763	.284	.2625	.0166	.011	.276	.219	.265625	2
3	.22942	.259	.2437	.0178	.012	.252	.212	.250	3
4	.20431	.238	.2253	.0188	.013	.232	.207	.234375	4
5	.18194	.220	.2070	.0202	.014	.212	.204	.21875	5
6	.16202	.203	.1920	.0215	.016	.192	.201	.203125	6
7	.14428	.180	.1770	.023	.018	.176	.199	.1875	7
8	.12849	.165	.1620	.0243	.020	.160	.197	.171875	8
9	.11443	.148	.1483	.0256	.022	.144	.194	.15625	9
10	.10189	.134	.1350	.027	.024	.128	.191	.140625	10
11	.090742	.120	.1205	.0284	.026	.116	.188	.125	11
12	.080808	.109	.1055	.0296	.029	.104	.185	.109375	12
13	.071961	.095	.0915	.0314	.031	.092	.182	.09375	13
14	.064084	.083	.0800	.0326	.033	.080	.180	.078125	14
15	.057068	.072	.0720	.0345	.035	.072	.178	.0703125	15
16	.05082	.065	.0625	.036	.037	.064	.175	.0625	16
17	.045257	.058	.0540	.0377	.039	.056	.172	.05625	17
18	.040303	.049	.0475	.0395	.041	.048	.168	.050	18
19	.03589	.042	.0410	.0414	.043	.040	.164	.04375	19
20	.031961	.035	.0348	.0434	.045	.036	.161	.0375	20
21	.028462	.032	.03175	.046	.047	.032	.157	.034375	21
22	.025347	.028	.0286	.0483	.049	.028	.155	.03125	22
23	.022571	.025	.0258	.051	.051	.024	.153	.028125	23
24	.0201	.022	.0230	.055	.055	.022	.151	.025	24
25	.0179	.020	.0204	.0586	.059	.020	.148	.021875	25
26	.01594	.018	.0181	.0626	.063	.018	.146	.01875	26
27	.014195	.016	.0173	.0658	.067	.0164	.143	.0171875	27
28	.012641	.014	.0162	.072	.071	.0149	.139	.015625	28
29	.011257	.013	.0150	.076	.075	.0136	.134	.0140625	29
30	.010025	.012	.0140	.080	.080	.0124	.127	.0125	30
31	.008928	.010	.0132	. .	.085	.0116	.120	.0109375	31
32	.00795	.009	.0128	. .	.090	.0108	.115	.01015625	32
33	.00708	.008	.0118	. .	.095	.0100	.112	.009375	33
34	.006304	.007	.0104	. .	. .	.0092	.110	.00859375	34
35	.005614	.005	.0095	. .	. .	.0084	.108	.0078125	35
36	.005	.004	.0090	. .	. .	.0076	.106	.00703125	36
37	.004453	. .	. .	. .	. .	.0068	.103	.006640625	37
38	.003965	. .	. .	. .	. .	.0060	.101	.00625	38
39	.003531	. .	. .	. .	. .	.0052	.099	. . . .	39
40	.003144	. .	. .	. .	. .	.0048	.097	. . . .	40



# Table of Decimal Equivalents

## OF STUBS' STEEL WIRE GAUGE.

Letter.	Size of Letter in Decimals.	No. of Wire Gauge.	Size of Number in Decimals.	No. of Wire Gauge.	Size of Number in Decimals.	No. of Wire Gauge.	Size of Number in Decimals.
Z	.413	1	.227	28	.139	55	.050
Y	.404	2	.219	29	.134	56	.045
X	.397	3	.212	30	.127	57	.042
W	.386	4	.207	31	.120	58	.041
V	.377	5	.204	32	.115	59	.040
U	.368	6	.201	33	.112	60	.039
T	.358	7	.199	34	.110	61	.038
S	.348	8	.197	35	.108	62	.037
R	.339	9	.194	36	.106	63	.036
Q	.332	10	.191	37	.103	64	.035
P	.323	11	.188	38	.101	65	.033
O	.316	12	.185	39	.099	66	.032
N	.302	13	.182	40	.097	67	.031
M	.295	14	.180	41	.095	68	.030
L	.290	15	.178	42	.092	69	.029
K	.281	16	.175	43	.088	70	.027
J	.277	17	.172	44	.085	71	.026
I	.272	18	.168	45	.081	72	.024
H	.266	19	.164	46	.079	73	.023
G	.261	20	.161	47	.077	74	.022
F	.257	21	.157	48	.075	75	.020
E	.250	22	.155	49	.072	76	.018
D	.246	23	.153	50	.069	77	.016
C	.242	24	.151	51	.066	78	.015
B	.238	25	.148	52	.063	79	.014
A	.234	26	.146	53	.058	80	.013
		27	.143	54	.055		

## Stubs' Gauges.

In using the gauges known as Stubs' Gauges, there should be constantly borne in mind the difference between the Stubs' Iron Wire Gauge and the Stubs' Steel Wire Gauge.

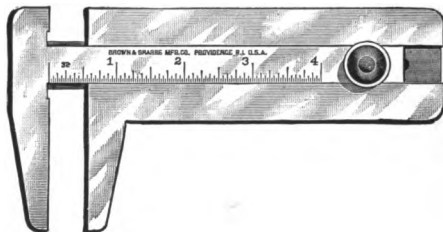
The Stubs' Iron Wire Gauge is the one commonly known as the English Standard Wire, or Birmingham Gauge and designates the Stubs' *soft* wire sizes.

The Stubs' Steel Wire Gauge is the one that is used in measuring drawn steel wire or drill rods of Stubs' make and is also used by many makers of American drill rods.

## Rolling Mill Caliper Gauge.

674

No. 674.

**Price, \$6 00.**

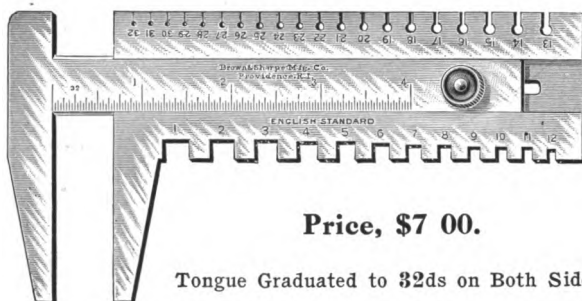
This Rolling Mill Caliper Gauge is intended for use on the heavy class of work found in rolling mills in measuring sheet iron and steel but can be used equally well in stock and store rooms.

It is 5 13-16" long and 7-32" thick. The jaws are 3 1-4" deep and can be drawn apart to measure 4". The tongue is graduated on one side to 32ds of an inch.

The caliper is made of tool steel, drop forged and is strong enough to withstand any strain to which it may be subjected. When the jaws are set they can be securely clamped so that measurements of different sheets of stock of the same thickness can be made without the necessity of resetting the caliper.

# Caliper and Wire Gauge, No. 677.

ENGLISH OR BIRMINGHAM STANDARD.



677

680

Price, \$7 00.

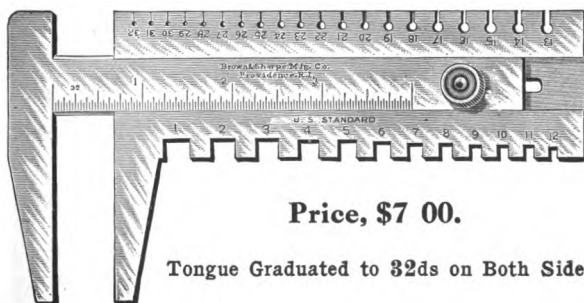
Tongue Graduated to 32ds on Both Sides.

This Caliper and Gauge is of steel, 5 3-4" long and about 3-16" thick. The jaws are 2" deep. The tongue is graduated on both sides to 32ds of an inch and can be drawn out to measure 4". The gauge numbers are those of the English or Birmingham Standard and run from 1 to 32.

The tool is found especially useful for stock and store room purposes in selecting iron, steel and sheet stock, also for iron and steel rollers' use. The Caliper is used for odd sizes of stock.

# Caliper and Wire Gauge, No. 680.

U. S. Standard for Sheet and Plate Iron and Steel.



Price, \$7 00.

Tongue Graduated to 32ds on Both Sides.

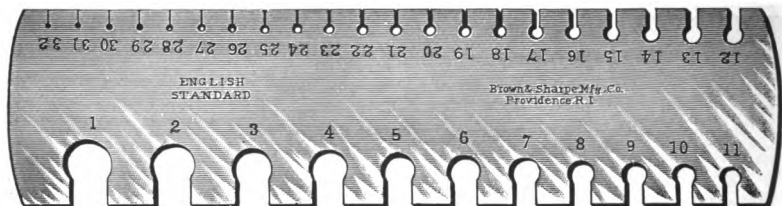
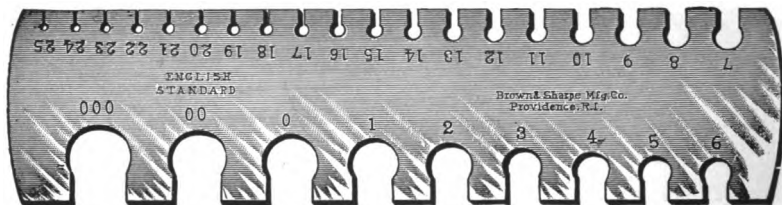
This Caliper and Gauge is similar in general design to that shown and described above, with the exception that the gauge numbers, which run from 1 to 32, are those of the U. S. Standard for Sheet and Plate Iron and Steel, adopted by Congress, March 3, 1893.

## Rolling Mill Gauges, No. 684.

ENGLISH OR BIRMINGHAM STANDARD.

684

685



Numbers 000 to 25, Price, \$2 50.

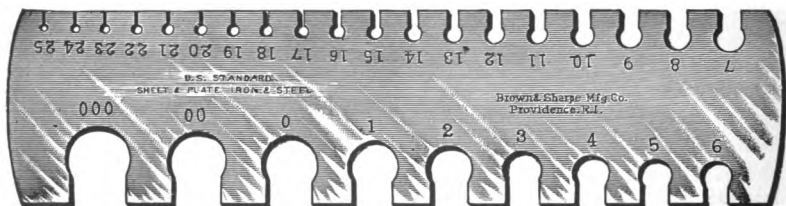
Numbers 1 to 32, Price, \$3 00.

These gauges are shown about two-thirds size and are made of steel, hardened and tempered. They are about 3-16ths of an inch thick and well adapted to the rough usage they are likely to have in rolling mills or in other places where many measurements are to be taken quickly.

## Rolling Mill Gauge, No. 685.

U. S. Standard Gauge for Sheet and Plate Iron and Steel.

Adopted by Congress, March 3, 1893.



Numbers 000 to 25, Price, \$2 50.

# American Standard Wire Gauge, No. 688.



Adopted by the  
Brass Manufacturers,  
January, 1858.

688

Decimal Equivalents stamped  
on Reverse Side.

690

Numbers 0 to 36.  
Price, \$2 50.

Numbers 5 to 36.  
Price, \$2 00.

For Table of the Different  
Standards of Wire Gauges,  
see page 144.

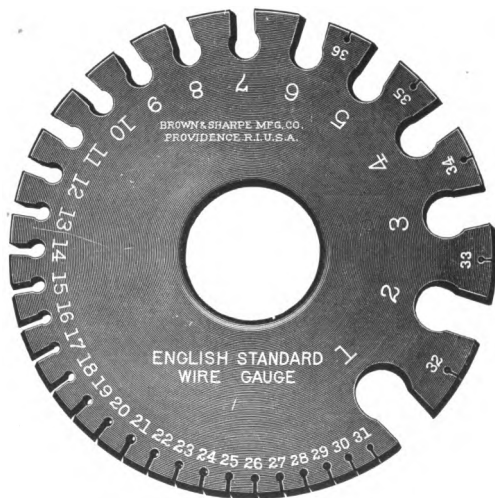
## English Standard Wire Gauge, No. 690.

The Same as Stubs' Iron  
Wire or Birmingham  
Gauge.

Decimal Equivalents stamped  
on Reverse Side.

Numbers 1 to 36.  
Price, \$2 50.

Numbers 6 to 36.  
Price, \$2 00.



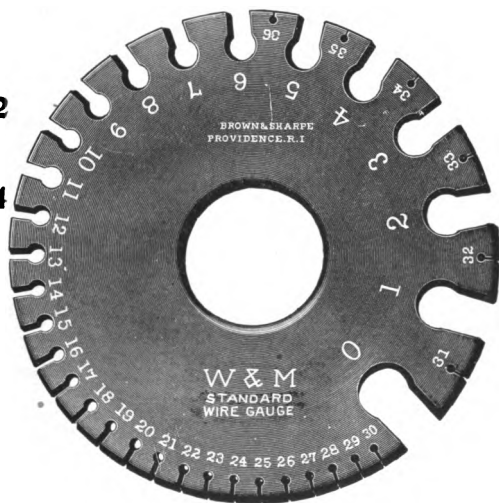
For Table of the Different Standards of Wire Gauges, see page 144.

# Washburn & Moen Standard Wire Gauge,

## No. 692.

692

694




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Numbers 0 to 36.

Price, \$2 50.

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For Table of the Different Standards of Wire Gauges, see page 144.

# U. S. Standard Gauge, No. 694.

Numbers 0 to 36.

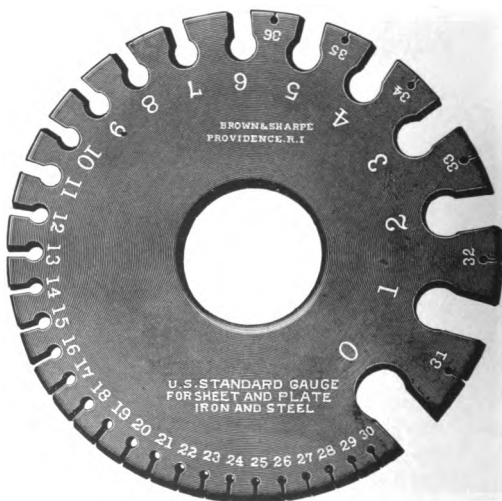
Price, \$2 50.

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U. S. Standard Gauge for Sheet and Plate Iron and Steel, adopted by Congress, March 3, 1893.

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For Table of the Different Standards of Wire Gauges, see page 144.



# Steel Music Wire Gauge, No. 695.

WASHBURN & MOEN STANDARD.

Numbers  
12 to 28.



Full Size.

695

Price, \$1 50.

696

Decimal Equivalents stamped on Reverse Side.

For Table of the Different Standards of Wire Gauges, see page 144.

# Steel Music Wire Gauge, No. 696.

AMERICAN S. & W. CO.'S NEW STANDARD.



Numbers 000000 to 33.

Price, \$2 50.

Decimal Equivalents stamped  
on Reverse Side.

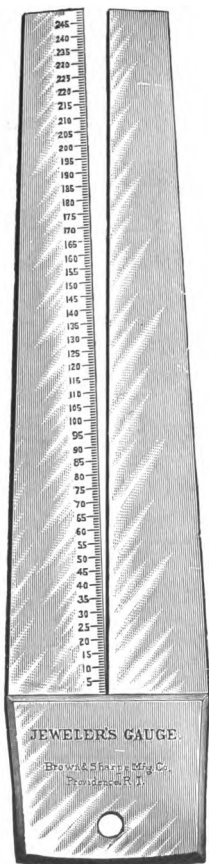
For Table of the Different  
Standards of Wire Gauges,  
see page 144.

# Jewelers Wire Gauge, No. 698.

Price, \$5 00.

698

This Gauge is shown about one-half size.

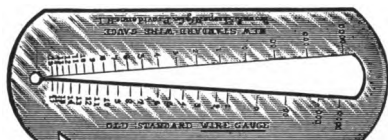
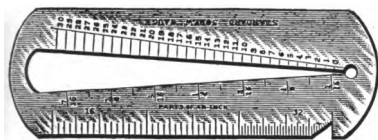


It is made with reference to the wants of Manufacturing Jewelers who frequently require a gauge for measuring the diameter of wire to thousandths of an inch. One edge of the angular slot is graduated into 250 parts to give the size in thousandths of an inch. Every fifth graduation is numbered.

In order to ascertain the exact size, the wire is passed down the slot until it stops, and the graduation on the scale at that point indicates the diameter. For example, a size of wire which passes down half-way into the slot, and stops opposite the 125, is  $\frac{125}{1000}$  of an inch in diameter. The angular slot has no sharp edge to injure the stock gauged.



## Pocket Screw and Wire Gauge, No. 700.



700

Price, \$2 50.

This gauge as shown is an angular gauge graduated on the front, at the left of slot, to show all sizes of the American Standard screw gauge from 0 to 30, and is designed for the measurement of wire as well as of machine and wood screws.

This gauge can also be used to show the sizes of A. S. M. E. Standard screws. Although there is a slight difference in size for the same gauge-number it is not enough to affect the reading of the gauge. For a comparison of these sizes see next page.

A screw or wire is measured by passing it into the angular opening till it touches on both sides; the division at the point of contact indicates the number of the gauge stamped on the side of the slot.

In addition to the gauge numbers, the front side of the gauge is also graduated on the left of slot to 32ds of an inch.

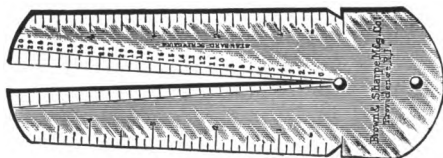
The back side of gauge is graduated as the old or English wire gauge, from 17 to 0000 on the right, and the new or American wire gauge from 15 to 0000 on the left of slot.

702

## Large Screw and Wire Gauge, No. 702.

Price, \$3 50.

Price, \$4 50, Extra Thick.



This gauge, as shown, is graduated on both sides of slot to show all sizes of the American Standard screw gauge from 0 to 30 and is designed for the measurement of wire as well as of machine and wood screws.

This gauge can also be used to show the sizes of A. S. M. E. Standard screws. Although there is a slight difference in size for the same gauge-number it is not enough to affect the reading of the gauge.

The front of the gauge is also graduated on both edges to 8ths of an inch. An angle cut in the side allows the head of the screw to be placed against a positive stop when measuring the length.

The back of the gauge is graduated as the old or English wire gauge from 17 to 0000, on the right, and to 32ds of an inch on the left of slot. The outer left hand edge is graduated to 32ds of an inch.

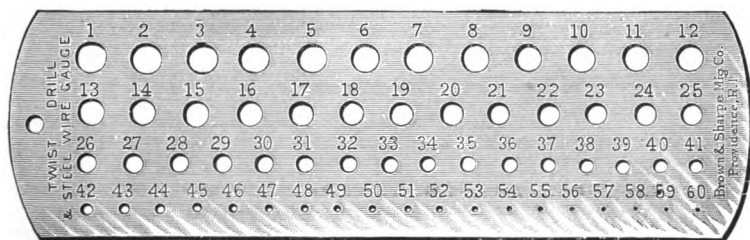
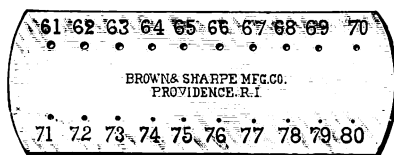
This gauge is also made about 5-32" thick and is known as "Extra Thick."

# Table of Decimal Equivalents of Screw Gauge For Machine and Wood Screws.

The difference between consecutive sizes is .01316" for American Screw Co. Standard; .013" for A. S. M. E. Standard.

No. of Screw Gauge.	Size of Number in Decimals.		No. of Screw Gauge.	Size of Number in Decimals.		No. of Screw Gauge.	Size of No. in Decimals.
	American Screw Co. Standard.	A. S. M. E. Basic and Maximum Outside Diameter.		American Screw Co. Standard.	A. S. M. E. Basic and Maximum Outside. Diameter.		American Screw Co. Standard.
000	.03152		16	.26840	.268	34	.50528
00	.04468		17	.28156		35	.51844
0	.05784	.060	18	.29472	.294	36	.53160
1	.07100	.073	19	.30788		37	.54476
2	.08416	.086	20	.32104	.320	38	.55792
3	.09732	.099	21	.33420		39	.57108
4	.11048	.112	22	.34736	.346	40	.58424
5	.12364	.125	23	.36052		41	.59740
6	.13680	.138	24	.37368	.372	42	.61056
7	.14996	.151	25	.38684		43	.62372
8	.16312	.164	26	.40000	.398	44	.63688
9	.17628	.177	27	.41316		45	.65004
10	.18944	.190	28	.42632	.424	46	.66320
11	.20260		29	.43948		47	.67636
12	.21576	.216	30	.45264	.450	48	.68952
13	.22892		31	.46580		49	.70268
14	.24208	.242	32	.47896		50	.71584
15	.25524		33	.49212			

# Twist Drill and Steel Wire Gauges, No. 705.

**705****Nos. 1 to 60.****Price, \$1 50.****Nos. 61 to 80.****Price, \$2 00.**

These Gauges are for use in determining the correct size of Twist Drills and Steel Drill Rods and great care is taken to insure the accuracy of the gauge numbers.

All sizes carefully tested after hardening.

The larger gauge is about 1-16" thick, 1 5-8" wide, 5 1-4" long and contains gauge numbers from 1 to 60, inclusive, with decimal equivalents of the various sizes stamped on reverse side. The smaller gauge is about 1-16" thick, 3-4" wide, 2" long and contains gauge numbers from 61 to 80, inclusive. These Gauges are usually sent out finished black but will be sent polished if desired.

Table of Decimal Equivalents of the Numbers of Twist Drill and Steel Wire Gauge, page 156.

# Decimal Equivalents

OF THE

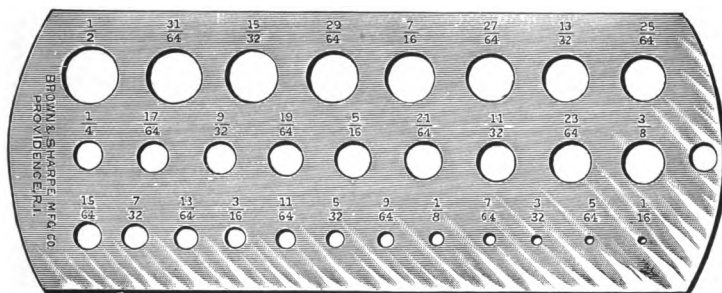
## Numbers of Twist Drill and Steel Wire Gauge.

No.	Size of No. in Decimals.	No.	Size of No. in Decimals.	No.	Size of No. in Decimals.	No.	Size of No. in Decimals.
1	.2280	21	.1590	41	.0960	61	.0390
2	.2210	22	.1570	42	.0935	62	.0380
3	.2130	23	.1540	43	.0890	63	.0370
4	.2090	24	.1520	44	.0860	64	.0360
5	.2055	25	.1495	45	.0820	65	.0350
6	.2040	26	.1470	46	.0810	66	.0330
7	.2010	27	.1440	47	.0785	67	.0320
8	.1990	28	.1405	48	.0760	68	.0310
9	.1960	29	.1360	49	.0730	69	.02925
10	.1935	30	.1285	50	.0700	70	.0280
11	.1910	31	.1200	51	.0670	71	.0260
12	.1890	32	.1160	52	.0635	72	.0250
13	.1850	33	.1130	53	.0595	73	.0240
14	.1820	34	.1110	54	.0550	74	.0225
15	.1800	35	.1100	55	.0520	75	.0210
16	.1770	36	.1065	56	.0465	76	.0200
17	.1730	37	.1040	57	.0430	77	.0180
18	.1695	38	.1015	58	.0420	78	.0160
19	.1660	39	.0995	59	.0410	79	.0145
20	.1610	40	.0980	60	.0400	80	.0135

# Jobbers' Drill Gauge, No. 710.

For Gauging Twist Drills.

710



Price, \$2 25.

This Gauge is of steel, hardened and tempered.

The sizes are carefully tested for accuracy after tempering.

This Gauge is sent out finished black but will be sent polished if desired.

## Equivalents of Sizes in Decimal Parts of an Inch.

Size.	Decimal.	Size.	Decimal.
1-16"	.0625	19-64"	.29687
5-64	.07812	5-16	.3125
3-32	.09375	21-64	.32812
7-64	.10937	11-32	.34375
1-8	.125	23-64	.35937
9-64	.14062	3-8	.375
5-32	.15625	25-64	.39062
11-64	.17187	13-32	.40625
3-16	.1875	27-64	.42187
13-64	.20312	7-16	.4375
7-32	.21875	29-64	.45312
15-64	.23437	15-32	.46875
1-4	.25	31-64	.48437
17-64	.26562	1-2	.50
9-32	.28125		

## Sizes of Tap Drills for U. S. Standard Threads.

By the formulas given below, the results, strictly speaking, are the diameters of the bottoms of the threads. The tap drill is, in common practice, one or two numbers larger, for the smaller, or numbered sizes, and about .005" larger for the larger sizes. The amount allowed for clearance varies in different shops and on different classes of work.

Bottom of Thread Diameter for U. S. Standard Thread = outside diameter of Screw —  $\frac{1.299}{\text{Threads per inch.}}$

Bottom of Thread Diameter for 3-4" Screw, U. S. Standard Thread, 10 threads to the inch =  $.750 - \frac{1.299}{10} = .750 - .1299 = .6201$ .

Diameter of Screw.	Threads per inch.	Diameter at bottom of Thread.	Diameter of Screw.	Threads per inch.	Diameter at bottom of Thread.
1-4"	20	.185"	2	4 1-2	1.712"
5-16	18	.240	2 1-4	4 1-2	1.962
3-8	16	.294	2 1-2	4	2.176
7-16	14	.344	2 3-4	4	2.426
1-2	13	.400	3	3 1-2	2.629
9-16	12	.454	3 1-4	3 1-2	2.879
5-8	11	.507	3 1-2	3 3-4	3.100
3-4	10	.620	3 3-4	3	3.317
7-8	9	.731	4	3	3.567
1	8	.837	4 1-4	2 7-8	3.798
1 1-8	7	.940	4 1-2	2 3-4	4.028
1 1-4	7	1.065	4 3-4	2 5-8	4.266
1 3-8	6	1.160	5	2 1-2	4.480
1 1-2	6	1.284	5 1-4	2 1-2	4.730
1 5-8	5 1-2	1.389	5 1-2	2 3-8	4.953
1 3-4	5	1.491	5 3-4	2 3-8	5.203
1 7-8	5	1.616	6	2 1-4	5.423

## Sizes of Tap Drills for V Threads.

Bottom of Thread Diameter for V Thread = outside diameter of Screw —  $\frac{1.732}{\text{Threads per inch.}}$

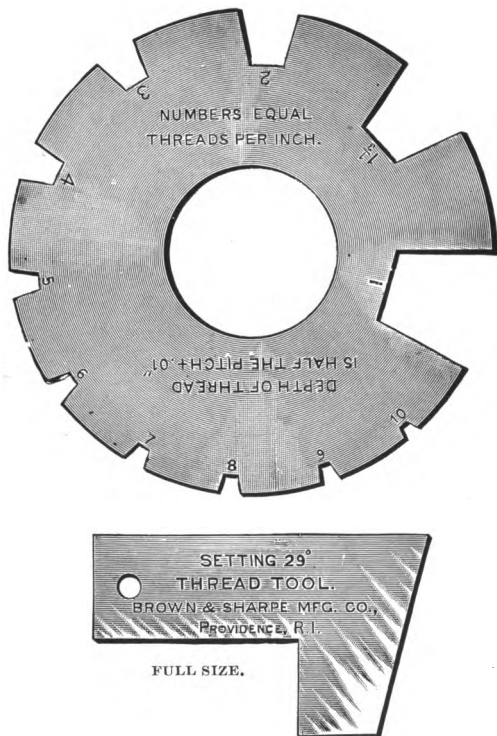
Bottom of Thread Diameter for 3-4" V Thread, 10 threads per inch =  $.750 - \frac{1.732}{10} = .750 - .1732 = .5768$ , diameter at bottom of thread.

The Tap Drill should be from .010 larger than above figures on small sizes to .030 larger on large sizes.

## 29° Screw Thread Tool Gauge, No. 715.

“ACME STANDARD.”

715



**Price, \$2 75.**

This Gauge is for the purpose of furnishing a correct standard to which tools can be ground to cut threads, of a uniform angle, to take the place of square threads, and to standardize the threads of various angles and depths now in use. This thread has the same depth as the square threads, but is stronger.

The sides are at an inclination of  $14\ 1-2^\circ$ , or  $29^\circ$  included angle, which angle is the same as is now generally adopted in cutting worms.

A tool setting gauge is furnished and included in the price of each gauge.

## 29° Screw Thread.

### ACME STANDARD.

The various parts of the 29° Screw Thread, Acme Standard, are obtained as follows:

Width of Point of Tool for

$$\text{Screw or Tap Thread} = \frac{.3707}{\text{Thds. per In.}} - .0052.$$

$$\text{Width of Screw or Nut Thread} = \frac{.3707}{\text{Thds. per In.}}$$

$$\text{Diameter of Tap} = \text{Diameter of Screw} + .020.$$

Diameter of Tap or Screw at Root =

$$\text{Diameter of Screw} - \left( \frac{1}{\text{Thds. per In.}} + .020 \right)$$

$$\text{Depth of Thread} = \frac{1}{2 \times \text{Thds. per In.}} + .010.$$

**TABLE OF THREAD PARTS.**

Threads per Inch.	Depth of Thread.	Thickness at Top of Thread.	Width Space at Bottom of Thread.	Space at Top of Thread.	Thickness at Root of Thread.
1	.5100	.3707	.3655	.6293	.6345
1 1-3	.3850	.2780	.2728	.4720	.4772
2	.2600	.1853	.1801	.3147	.3199
3	.1767	.1235	.1183	.2098	.2150
4	.1350	.0927	.0875	.1573	.1625
5	.1100	.0741	.0689	.1259	.1311
6	.0933	.0618	.0566	.1049	.1101
7	.0814	.0529	.0478	.0899	.0951
8	.0725	.0463	.0411	.0787	.0839
9	.0655	.0413	.0361	.0699	.0751
10	.0600	.0371	.0319	.0629	.0681



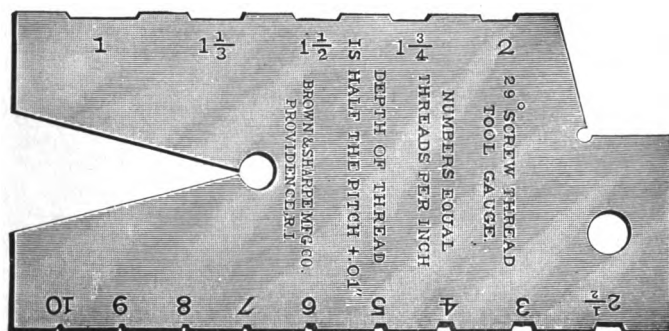
# Improved

## 29° Screw Thread Tool Gauge,

### No. 716.

716

"ACME STANDARD."



Price, \$2 50.

This Gauge is new in design and furnishes a correct standard to which tools can be ground to cut threads of a uniform angle to take the place of square threads.

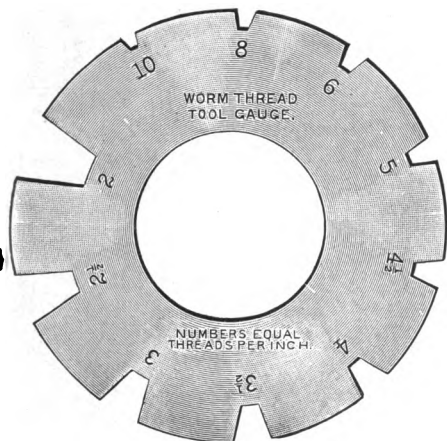
The thread has the same depth as the square threads but as the sides are at an inclination of  $14\ 1\text{--}2^\circ$  ( $29^\circ$  included angle) this form of thread is stronger and is now generally adopted in cutting worms.

This Gauge is made of the best steel, tempered, adjusted and all angles carefully tested after hardening.

# U. S. Standard Screw Threads.

Diameter of Screw at Top of Thread.	Threads per Inch.	Diameter at Root of Thread.	Width of Flat, Top and Bottom.
1-4"	20	.185"	.0063"
5-16	18	.2403	.0069
3-8	16	.2936	.0078
7-16	14	.3447	.0089
1-2	13	.4001	.0096
9-16	12	.4542	.0104
5-8	11	.5069	.0114
3-4	10	.6201	.0125
7-8	9	.7307	.0139
1	8	.8376	.0156
1 1-8	7	.9394	.0179
1 1-4	7	1.0644	.0179
1 3-8	6	1.1585	.0208
1 1-2	6	1.2835	.0208
1 5-8	5 1-2	1.3888	.0227
1 3-4	5	1.4902	.0250
1 7-8	5	1.6152	.0250
2	4 1-2	1.7113	.0278
2 1-4	4 1-2	1.9613	.0278
2 1-2	4	2.1752	.0313
2 3-4	4	2.4252	.0313
3	3 1-2	2.6288	.0357
3 1-4	3 1-2	2.8788	.0357
3 1-2	3 1-4	3.1003	.0385
3 3-4	3	3.3170	.0417
4	3	3.5670	.0417
4 1-4	2 7-8	3.7982	.0435
4 1-2	2 3-4	4.0276	.0455
4 3-4	2 5-8	4.2551	.0476
5	2 1-2	4.4804	.0500
5 1-4	2 1-2	4.7304	.0500
5 1-2	2 3-8	4.9530	.0526
5 3-4	2 3-8	5.2030	.0526
6	2 1-4	5.4226	.0556

## Worm Thread Tool Gauge, No. 720.



Full size.

Price, \$2 50.

Price, with Tool Setting Gauge, 720

\$2 75.

This Gauge furnishes the correct form for tools used in turning the threads of worms, when the worm wheels are cut with involute cutters. The figures on the gauge correspond to the number of threads per inch of the worm.

## Standard Screw Thread Tool Gauge, No. 724.

Price, \$2 50.

This Gauge is to be used as a standard for grinding tools to cut threads according to the United States Standard.

The angles are 60 degrees and the flat surfaces at top and bottom of threads are equal to one-eighth of the pitch.



Full size.

## Depth of Gear Tooth Gauges, No. 725.

725



728

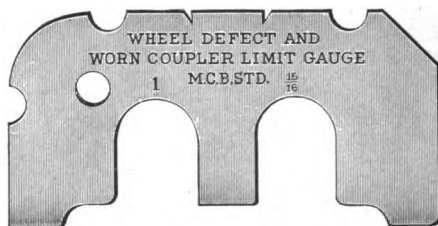
**Price, 25 Cents Each.**

**Price, Sizes to 3 Pitch, made to order, 75 Cents Each.**

**Larger Sizes, \$1 25.**

Depth of Gear Tooth Gauges for all regular pitches, from 3 to 48 pitch inclusive, are carried in stock. One gauge answers for each pitch and indicates the extreme depth to be cut.

## Wheel Defect and Worn Coupler Limit Gauge, No. 728.



**Price, \$2 50.**

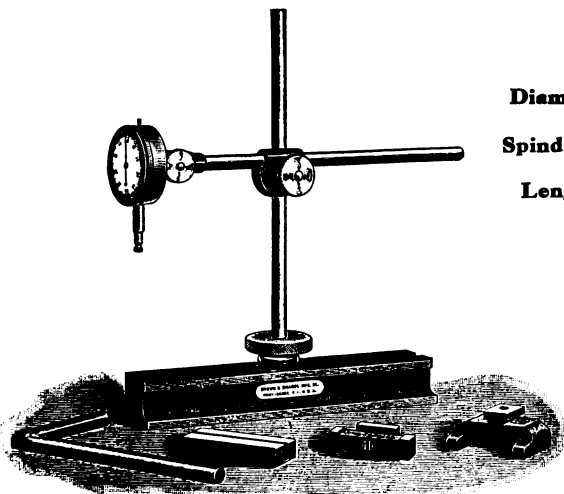
This Gauge is designed for ascertaining the extent of defects and wear in car wheels and couplers, according to the standard adopted by the Master Car Builders' Association.

It is shown about half size and is made of the first quality tool steel, hardened. The measuring surfaces are accurately ground and finished to size. After hardening, they are carefully tested for accuracy.

## Dial Test Indicator, No. 730.

· ENGLISH OR METRIC MEASURE.

730



Diameter of Dial, 1 3-4". 732

Spindle has 1-4" movement.

Length of Base, 8 1-2".

Width, 2 1-4".

Price, \$20 00.

This Indicator is especially serviceable to those erecting or inspecting machines in determining the inaccuracy in a surface or the movements of a spindle or arbor, etc.

The parts are adjustable to any angle. The arm can be removed from the post and used independently, as in the tool post of a lathe. The points are removable to permit the use of different forms. The movement of the measuring surface that bears upon the work is magnified a number of times and indicated by the pointer. The dial reads to .001", has a white enamel face and is adjustable to allow the setting of the zero to any required position.

**Metric Measure.** Also made with Metric Dial and reads to 1-100 m/m.

## Dial Test Indicator, No. 732.

ENGLISH OR METRIC MEASURE.

Price, \$35 00.

This Indicator differs from No. 730, in the range and size. It is designed for a heavier class of work. Diameter of dial, 2 1-4". Spindle has 1-2" movement. Length of base, 10"; width, 3"

## Dial Test Indicator, No. 733.

ENGLISH OR METRIC MEASURE.

Diameter of Dial, 1 3-4".

Length of Base, 4 1-4".

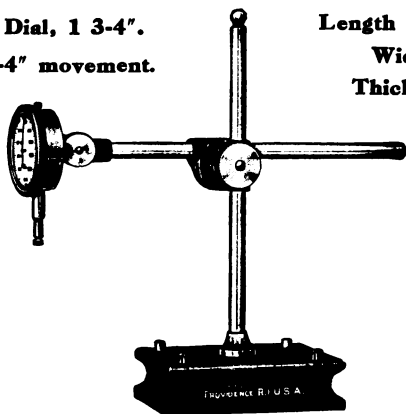
Spindle has 1-4" movement.

Width, 3 1-4".

Thickness, 1 1-8".

733

734



Price, \$15 00.

This Indicator differs from the No. 730, shown on the preceding page, in the design of the base.

The base is large and sufficiently heavy to give a firm support. It has four gauge pins at the corners that can be pushed down and used against a plate, straight edge or the side of a T slot. The form of the base permits a good hand grip when moving the Indicator.

The dial reads to .001", has a white enamel face and is adjustable to allow the setting of the zero to any required position. The spindle has 1-4" movement.

**Metric Measure.** This Indicator is also made with a Metric Dial that reads to 1-100th of a millimetre.

## Universal Attachment, No. 734.

For Use on Dial Test Indicators, Nos. 730, 732 and 733.



This attachment is designed for the purpose of testing internal and other surfaces that cannot be reached conveniently with the regular straight spindle of the indicator.

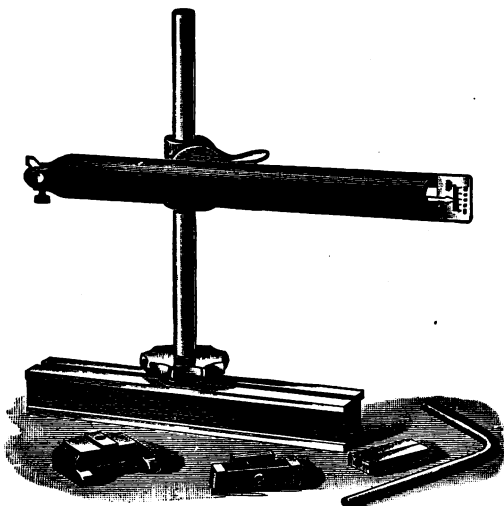
It consists of a small steel cylinder that clamps over the end of the indicator spindle. Inside the cylinder a small rod rests against the indicator point. This rod is actuated vertically by the attachment indicating point that extends at right angles to the regular indicator spindle and is so placed that it produces a direct thrust against the end of the spindle without friction on the side of the cylinder.

Price, \$1 50.

## Test Indicator, No. 735.

ENGLISH OR METRIC MEASURE.

735



Price, \$15 00.

Length of Base, 8".

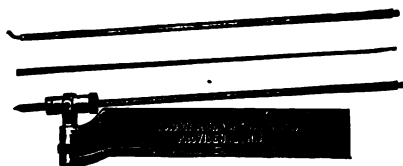
Height of Post, 9".

This Indicator is especially useful to those erecting or inspecting machines. The parts are adjustable to any angle. The movement of the point is magnified a number of times by the length of the index finger and its movement may be read upon the graduations shown. The indexing finger may be brought to zero by the knurl headed screw shown, whatever may be the position of the arm. The graduations read to thousandths of an inch.

**Metric Measure.** This Indicator is also made to read to 1-50 m/m.

## Lathe Test Indicator, No. 736.

736



Price, \$3 00.

**738** This Indicator is made of steel and is of such a size as to be held conveniently in the tool post of a lathe. The bar, 15-16" wide and 3-8" thick, is drop forged and formed at the end to receive a Universal Joint for supporting the finger holder.

A clamp nut is provided for clamping the joint when it is desired to have only a vertical movement to the finger, as in testing pieces held between centres, the inside or outside of pulleys, etc. The bushing, which holds the finger, is split, thus allowing the finger to be adjusted to lengths required and clamped in position.

The finger holder is furnished with two fingers, either one of which can be quickly attached; one finger is ground to an angle of 60° and the other is bent for inside and outside testing. A spiral spring is provided for holding the finger against the work with an even pressure.

## B & S Indicator, No. 738.

English or  
Metric  
Measure.



Price, \$5 75.

Morocco Case,  
\$0 50.

Patented July 24, 1906.

This Indicator is intended for use in setting centrally any point or hole in a piece of work to be operated upon in a lathe or upon a face plate, also for testing lathe centres, shafting and other work held between centres, the inside and outside diameters of cylinders, pulleys, etc., and work of a similar nature.

The shank is made of hardened steel and is designed to be held in the tool post of a lathe. By means of the swivel at one end of the shank, the Indicator may be adjusted either upwards or downwards and readings obtained.

The Indicator point is of steel, hardened, and is made spherical, allowing of pressure being brought upon it by the work from any angle and readings taken.

The readings are obtained by means of the pointer and scale on the top of the case. The scale is graduated to read to approximately .007" either side of zero. In this way, the amount that the piece may run out of true, both under and over size, is easily ascertained.

**Metric Measure.** This Indicator is also made to read to metric measurements, reading to approximately 1 m/m either side of zero by hundredths of a m/m.



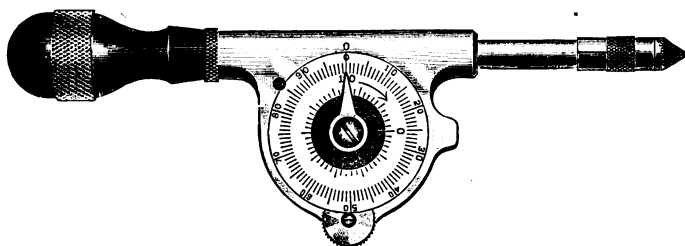
## B & S Speed Indicator, No. 748.

Price, \$5 50.

In Morocco Case, \$6 00.

748

Patented March 8, 1910.



This Indicator is intended for use in determining the velocity of shafts and spindles running in either direction. It registers on either side, the front side being used to determine the velocity of shafts and spindles running in one direction and the reverse side the speed of those running in the opposite direction. Thus the confusion and errors that arise where all readings are taken from one dial are avoided.

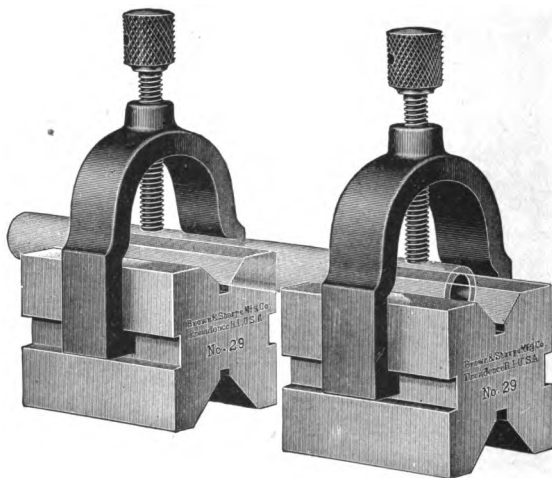
The dials register units and tens by means of a revolving pointer and, in addition, the front dial registers hundreds up to 5000 by means of a rotating disk in the centre. This disk will register when either side is used.

Quick use of the tool is greatly facilitated by means of a small knurled wheel on the side of the case which, when turned, reverts the rotating disk on the front dial to the starting point. This is distinctly a B & S feature. The pointers are readjusted by simply turning the indicator spindle.

The Indicator is small, light and convenient to handle. All of the working mechanism is encased and the case is heavily nicked with a dull finish. The point is of steel, hardened, and can be readily removed when worn.

## V Blocks and Clamps, No. 750.

750



**Price, \$5 50.**

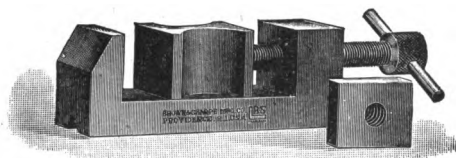
These V Blocks are designed particularly for laying out work accurately in connection with a surface plate and knee.

The blocks, which are made of tool steel hardened, have the sides ground parallel and the V grooves carefully ground central and parallel to the bottom and sides. They are made and sold only in numbered pairs, so that the V grooves in blocks of the same numbers are always in alignment.

Each block is approximately 1 1-4" x 1 1-4" x 1 5-8" in size and will take work to 1" in diameter.

They are not sold singly.

## B & S Toolmakers Vise, No. 752.



752

**Price, \$1 25.**

754

This Vise is a reliable and handy tool for use in drilling, fitting, and laying out work on surface plates. The screw will hold the jaws rigidly in place.

It is drop-forged and case-hardened, thus adapting it for hard usage without danger of damaging it. It is also light and convenient to handle, being frequently held in the hand during operations. The distinctive B & S feature in this tool is the V groove in the under side of the base. This adds to the handiness of the Vise as it can be used as a V block.

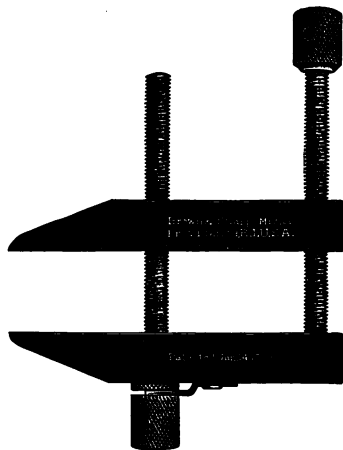
The greatest capacity of the Vise is 2". Each Vise is furnished with two steel jaws as shown in the cut that slip on and off the end of the screw.

## Improved Tool Makers Clamps, No. 754.

Patented Jan. 14, 1903.

These Clamps are designed and proportioned throughout to insure the greatest strength and rigidity. The jaws are rounded on the ends to allow clamping under a shoulder or recess. The spring attachment holds the "loose" jaw tightly and prevents its dropping or sliding while opening or closing the clamp.

They are very convenient where a large number of pieces of the same size are to be clamped for drilling, as the spring attachment holds the jaws at the required distance for removing and inserting each piece.



No.	Opening of Jaws.	Length of Jaws.	Price Each.
<b>754</b>	5-8"	1 1-2"	\$0 60
	1	2 1-8	70
	1 1-2	2 3-4	85
	2	3 3-8	1 00
	2 1-2	4	1 10
	3 1-2	5	1 75

## Nail Sets, No. 762.

762

765



These Nail Sets are of tool steel, carefully hardened. They are of convenient sizes, about 4" in length and are knurled to provide a good finger grip. The points are concave and the edges rounded.

Number.	Diameter at Point.	Price.
<b>762</b>	1-16"	\$0 20
	3-32	20
	1-8	20
	5-32	20
	7-32	25

Price per dozen, \$2 20.

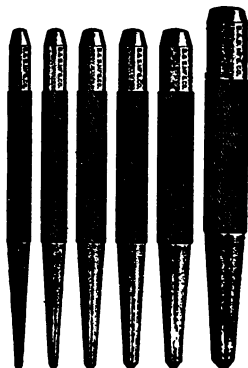
## Machinists Centre Punches, No. 765.

These Centre Punches are made with the intention that they shall be a little better than the ordinary requirements of such tools demand.

They are of convenient sizes and knurled on the body to afford a good finger grip. Both ends are tempered and the points carefully ground to an angle. They are about 4 inches in length.

Number.	Diameter at Top of Tapered Point	Price.
<b>765</b>	1-16"	\$0 20
	5-64	20
	3-32	20
	9-64	20
	5-32	20
	15-64	20

Price per dozen, \$2 00.



## Automatic Centre Punches, No. 770.

Patented: United States, Feb. 7 and Feb. 28, 1905; England, Dec. 1, 1904; Belgium, Dec. 13, 1904; France, Dec. 12, 1904; Switzerland, July 7, 1905.

Style 1.	4 1-8" long, 3-8" diameter.	Price, \$1 25.	770
Style 2.	5 1-4" long, 5-8" diameter.	Price, \$1 50.	
Style 3.	6" long, 3-4" diameter.	Price, \$2 50.	
Style 4.	11 3-4" long, 1 3-8" diameter. For Heavy Work. }	Price, \$25 00.	

The Automatic Centre Punch is more convenient for laying out work to be drilled than the ordinary centre punch and hammer.

The tool is of steel, the striking mechanism being enclosed in the knurled handle. Styles 1, 2 and 3 are of such a size and form as to be held conveniently in the hand. A downward pressure releases the striking block and makes the impression. The punch marks are of uniform depth.

The points on Styles 2, 3 and 4 punches can be taken out for grinding and are easily replaced if broken.

Style 1 is adapted for carrying in the pocket, and is made to meet the demand for a small, light tool of its class suitable for the more delicate work required in tool making.

The Style 3 punch differs from the Style 2 punch in being slightly heavier in construction and capable of striking a much heavier blow.

The Style 4 punch, which is considerably heavier in construction than the Style 3 punch, is designed for use in rolling mills for testing the hardness of metal, or is very useful in hardening rooms, for testing the variation in depth in case-hardening. It is also suitable for laying out work to be drilled, where the Style 3 punch would not strike a sufficiently heavy blow.

**Extra Points** can be furnished as follows:

For Style 2 Punch, \$0 15; for the Style 3 Punch, \$0 15; for the Style 4 Punch, \$0 25.



## Automatic Centre Punch, No. 771.

Price, \$2 00.

771

**ADJUSTABLE.**

**5 1-4" long, 5-8" diameter.**

Patented: United States, Feb. 7 and Feb. 28, 1905, June 2, 1908; Great Britain, Dec. 1, 1904; Belgium, Dec. 13, 1904; France, Dec. 12, 1904; Switzerland, July 7, 1905.

The Automatic Centre Punch is new in design and combines features that make it much more convenient for laying out work to be machined or drilled than the ordinary centre punch and hammer.

This Centre Punch is similar in construction to the No. 770, excepting that the length of stroke is adjustable. This feature is one that is readily appreciated by mechanics as it adapts the tool to all varieties of tool and general shop work.

For example: If a piece of tool work is to be laid out, fine punch marks are required for the outline, but for general shop work as centering for drills, etc., much heavier marks are necessary and the convenience of having a tool that can be readily adjusted to meet both conditions is apparent.

The adjustment of the stroke is made by the knurled thumb screw on the top of the handle. To adjust for fine work requiring a light mark, turn the screw to the right; for coarse work turn screw to the left.

The points can be taken out for grinding and are easily replaced if broken.

**Extra Points. Price, \$0 15.**



## Spacing Attachment, No. 775.

Price, \$2 50.

Capacity, Beam 4" Long, Swings 8".

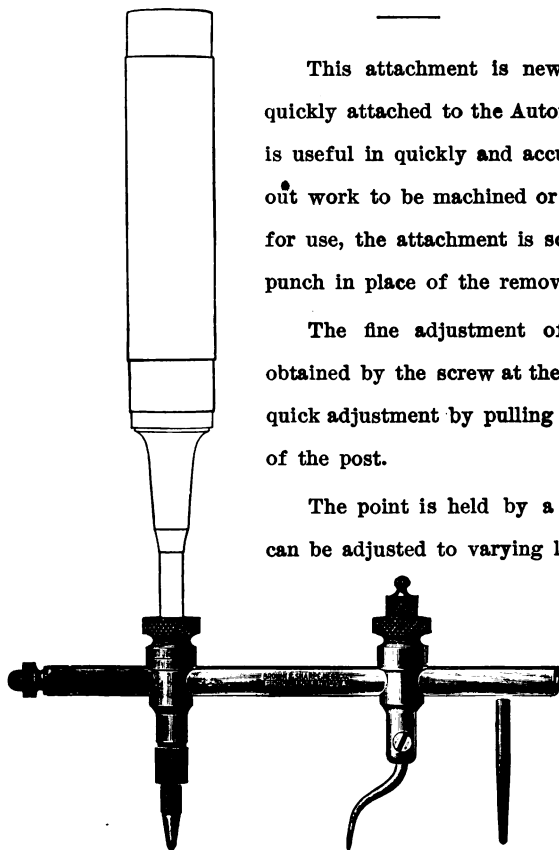
775

To be used with No. 770, Style 2 and No. 771  
Automatic Centre Punches.

This attachment is new in design and can be quickly attached to the Automatic Centre Punch. It is useful in quickly and accurately spacing or laying out work to be machined or drilled. When adjusted for use, the attachment is screwed on to the centre punch in place of the removable point.

The fine adjustment of the locating point is obtained by the screw at the end of the beam and the quick adjustment by pulling out the knob at the top of the post.

The point is held by a knurled check nut and can be adjusted to varying lengths.



Extra Points  
for Attachment.

Price,  
\$0 15 each.

## B & S Scribers, No. 778.

778



Style 2.

**Style 1, Single Point, Pocket.**

**Price, \$0 40.**

**Style 2, Single Point, 5" long.**

**Price, \$0 30.**

**Style 3, Double Point, 8" long.**

**Price, \$0 35.**

These scribers are made with the intention that they shall be a little better than the ordinary requirements of such a tool demand.

The points are of tool steel, finely tempered. They are threaded to screw into the holder and knurled for a finger grip. The knurled holder has long bearings to support the points firmly when in place and is of suitable size to be held conveniently.

Style 1 is adapted for carrying in the pocket. The point is held in the handle by a four jawed chuck, by which it can be set concentrically and held firmly at any position. The point may be reversed and the scriber closed for carrying in pocket to about 3 1-2" in length.



Style 3.



Style 1.



## Mercury Plumb Bobs, No. 790.

790

An important feature is the device for fastening the string without a knot, to any desired length. After unwinding the required length, the cord is inserted in a slot in a taper stud, and the knurled cap, which has a taper hole, is forced over it, thus making the bob hang true.

These Plumb Bobs are made from a solid steel rod, bored out and filled with mercury, or quicksilver, which makes them unusually heavy in proportion to their size. The center of gravity is low. The cut at the left shows the manner in which these Plumb Bobs are constructed. The comparatively small diameters allow them to be used close to corners and walls. They are not easily affected by draughts of air and are convenient to be carried or packed in small spaces.

The points are hardened and the bodies and points are ground. The Plumb Bobs are nickel-plated and each is furnished with a braided silk line. The 3 1-2 oz. can be carried easily in the vest pocket.



### PRICES.

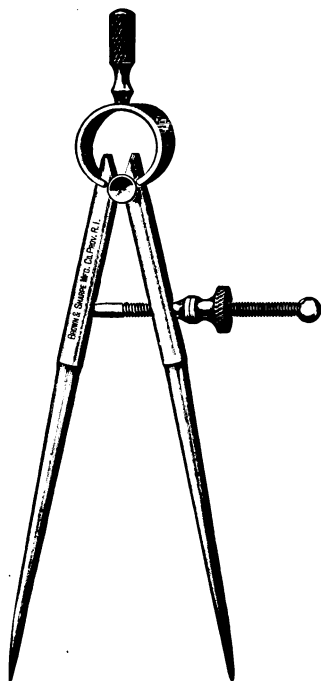
	3 1-2 oz.,	4" long.	1-2" diam.,	\$1 25
6	"	4 1-2 "	5-8 "	1 75
12	"	5 3-8 "	7-8 "	2 25
16	"	6 "	1 "	2 75

## B & S Tool Makers Calipers and Dividers.

800

These Calipers and Dividers present features not previously embodied in tools of this class. The fulcrum stud is hardened. The spring is unusually stiff and of a construction that insures rigidity, prevents side deflection of the legs and gives uniform pressure. The legs are of steel, round and highly polished; the measuring points come together evenly.

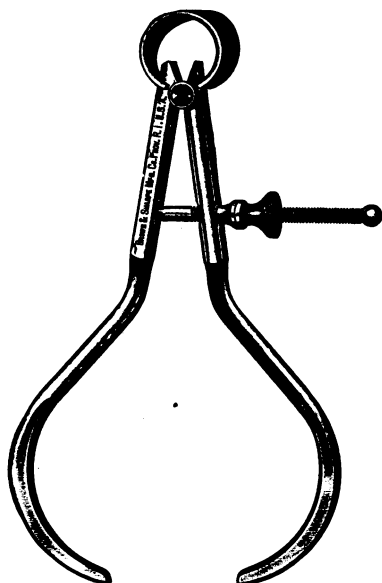
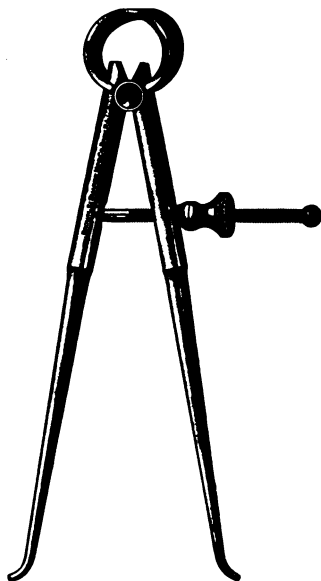
Especial attention is called to the 2" sizes, as they are convenient for small, light work and for the pocket.



### B & S Tool Makers Dividers, No. 800.

No.	Size.	Price.
<b>800</b>	2"	\$1 00
	3	1 25
	4	1 50
	5	1 50
	6	1 75

# B & S Tool Makers Outside and Inside Calipers.

**OUTSIDE.****801****802****INSIDE.**

No.	Size.	Price.	No.	Size.	Price.
<b>801</b>	2"	\$1 00	<b>802</b>	2"	\$1 00
	3	1 25		3	1 25
	4	1 50		4	1 50
	5	1 50		5	1 50
	6	1 75		6	1 75

## Duplicate Parts for Tool Makers Calipers and Dividers.

Leg . . . . .	\$0 35
Screw and Ball . . . . .	15
Nut . . . . .	10
Spring . . . . .	25
Spring with Thumb Attachment for Dividers . . . . .	40
Thumb Attachment . . . . .	15
Nut Washer . . . . .	05
Fulcrum Stud . . . . .	10

## Brown & Sharpe

### Spring Calipers and Dividers.

**805** These Calipers and Dividers combine lightness and durability. The legs are steel drop forgings finished in the best manner possible.

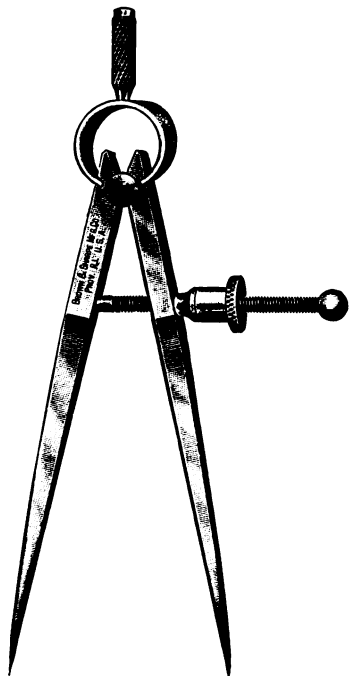
The spring is unusually stiff and of improved form, with convex ends that fit into concave grooves, milled in the ends of the legs, insuring great rigidity.

The spring nut is constructed on the principle of the spring chuck with the jaws hardened. It is positive in action when closing, the thread engaging the screw on the slightest pressure. When the pressure is withdrawn the nut is released at once and slides freely on the screw. It is dust proof and combines all the



advantages of the solid nut with that of quick adjustment. There are no loose pieces.

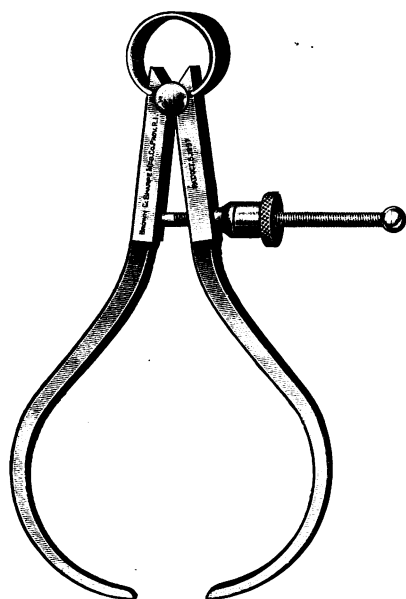
The screw is of steel hardened to prevent wear and a thumb attachment is provided for Spring Dividers.



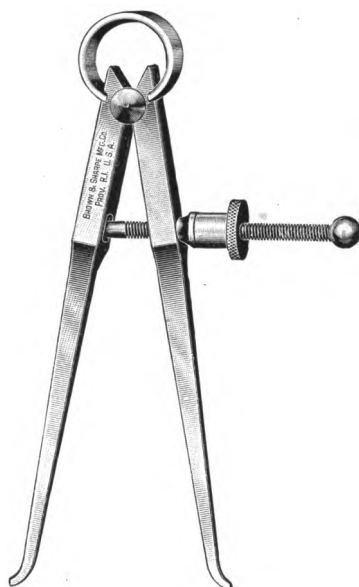
### B & S Spring Dividers, No. 805.

No.	Size.	Price with Spring Nut.	Price with Solid Nut.
<b>805</b>	2 1-2"	\$1 15	\$1 00
	3	1 15	1 00
	4	1 40	1 25
	5	1 40	1 25
	6	1 75	1 60

# Brown & Sharpe Outside and Inside Spring Calipers.



806



807

## OUTSIDE.

No.	Size.	Price with Spring Nut.	Price with Solid Nut.
806	2 1-2"	\$1 15	\$1 00
	3	1 15	1 00
	4	1 25	1 10
	5	1 25	1 10
	6	1 50	1 35

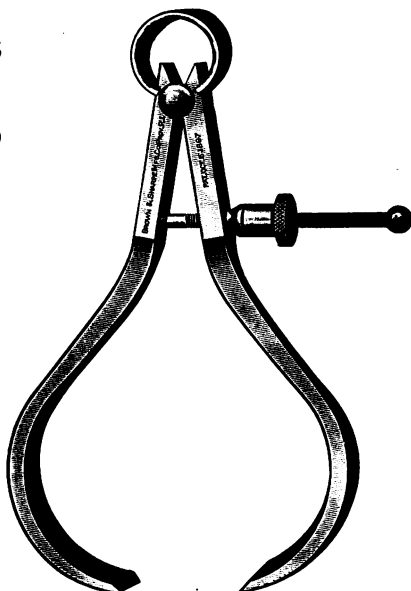
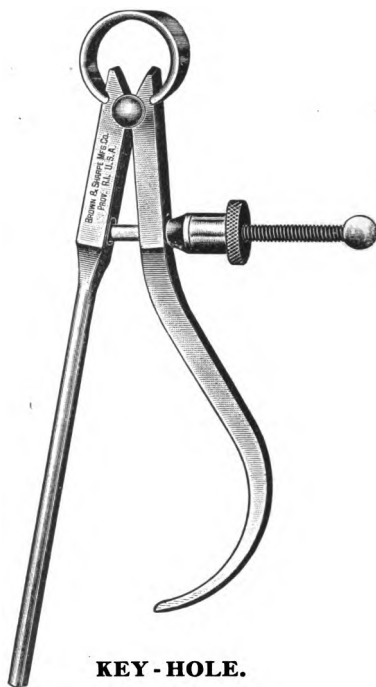
## INSIDE.

No.	Size.	Price with Spring Nut.	Price with Solid Nut.
807	3"	\$1 15	\$1 00
	4	1 25	1 10
	5	1 25	1 10
	6	1 50	1 35

## Brown & Sharpe Thread and Keyhole Spring Calipers.

808

809

**THREAD.****KEY-HOLE.**

No.	Size.	Price with Spring Nut	Price with Solid Nut.	No.	Size.	Price with Spring Nut	Price with Solid Nut.
<b>808</b>	3"	\$1 15	\$1 00	<b>809</b>	3"	\$1 15	\$1 00
	4	1 25	1 10		4	1 25	1 10
	5	1 25	1 10				

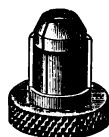
### Duplicate Parts for Brown & Sharpe Spring Calipers and Dividers.

Leg . . . . .	\$0 35
Screw and Ball . . . . .	15
Solid Nut . . . . .	10
Spring . . . . .	25
Spring with Thumb Attachment for Dividers . . . . .	40
Spring Nut . . . . .	25
Nut Washer . . . . .	10
Thumb Attachment . . . . .	15

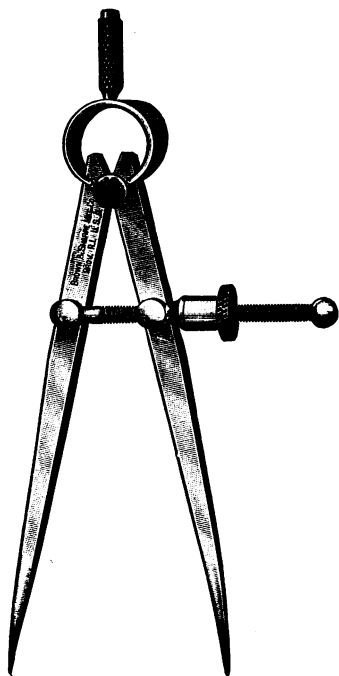
## Rex Spring Calipers and Dividers.

These Calipers and Dividers are somewhat lighter than the **810** Brown & Sharpe, but the same care is taken in their construction as in the more expensive line: the same spring, fitted to the legs in a somewhat different manner, is used and the same Spring Nut.

The Rex Calipers are neat and attractive in appearance, and durable.



The adjusting screw is hardened to prevent wear, and a thumb attachment is provided for the Spring Dividers.



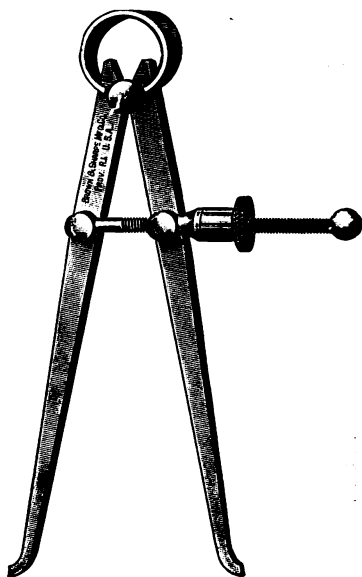
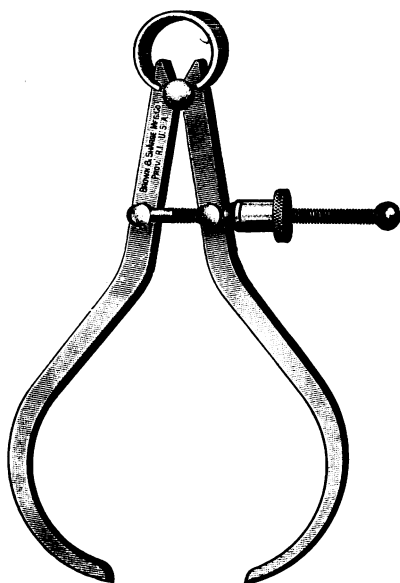
### Rex Spring Dividers, No. 810.

No.	Size.	Price with Spring Nut.	Price with Solid Nut.
<b>810</b>	2 1-2"	\$0 80	\$0 65
	3	85	70
	4	90	75
	5	95	80
	6	1 00	85
	8	1 15	1 00

# Rex Outside and Inside Spring Calipers.

811

812



## OUTSIDE.

## INSIDE.

No.	Size.	Price with Spring Nut	Price with Solid Nut.	No.	Size.	Price with Spring Nut	Price with Solid Nut.
811	2 1-2"	\$0 80	\$0 65	812	2 1-2"	\$0 80	\$0 65
	3	85	70		3	85	70
	4	90	75		4	90	75
	5	95	80		5	95	80
	6	1 00	85		6	1 00	85
	8	1 15	1 00		8	1 15	1 00

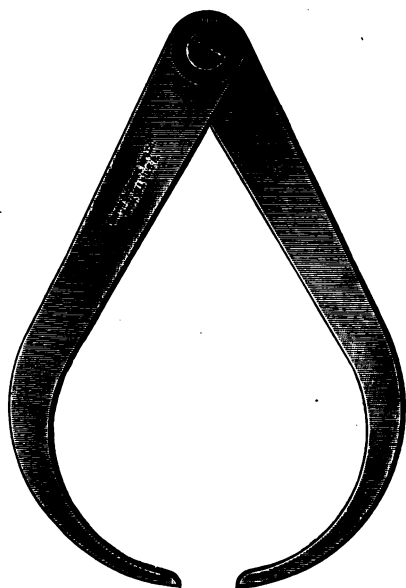
## Duplicate Parts for Rex Calipers and Dividers.

Leg . . . . .	\$0 25
Screw and Ball . . . . .	15
Solid Nut . . . . .	10
Spring . . . . .	25
Spring with Thumb Attachment for Dividers . . . . .	40
Spring Nut . . . . .	25
Nut Washer . . . . .	10
Thumb Attachment . . . . .	15

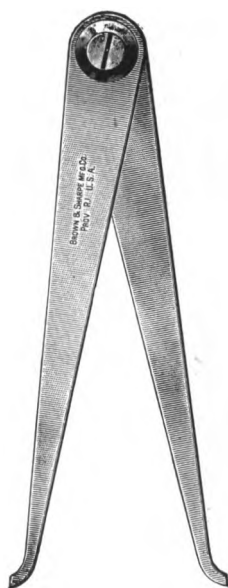


# Firm Joint Calipers, Outside and Inside.

TEMPERED.



821



822

OUTSIDE.

INSIDE.

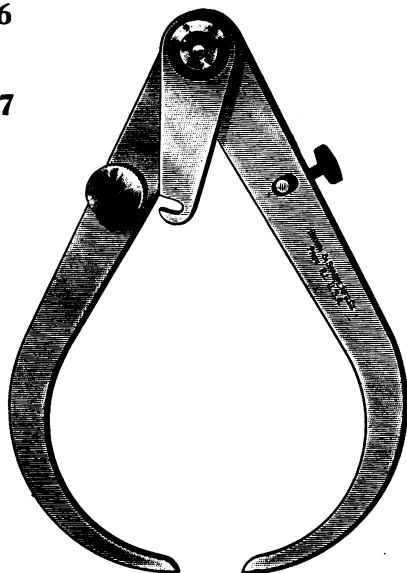
No.	Size.	Price.	No.	Size.	Price.
821	3"	\$0 40	822	3"	\$0 40
	4	50		4	50
	5	55		5	55
	6	65		6	65
	8	80		8	80
	10	90		10	90
	12	1 00		12	1 00
	14	1 50		14	1 50
	16	1 75		16	1 75
	18	2 10		18	2 10
	20	2 50		20	2 50
	24	3 00		24	3 00

# Transfer Firm Joint Calipers.

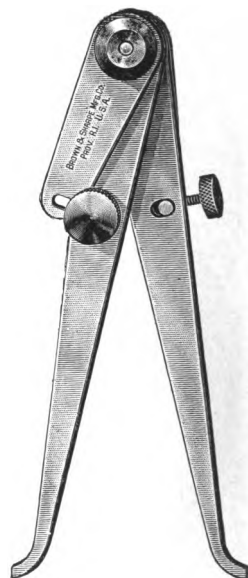
TEMPERED.

826

827



OUTSIDE.

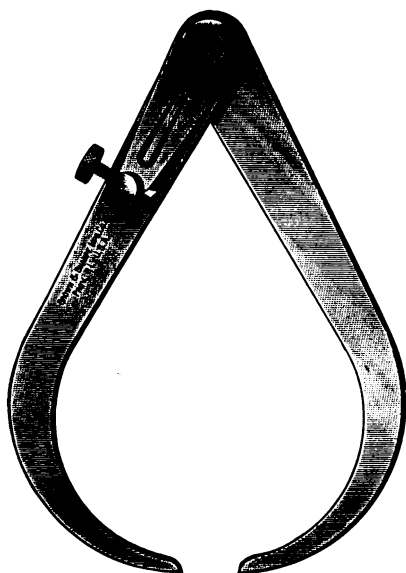


INSIDE.

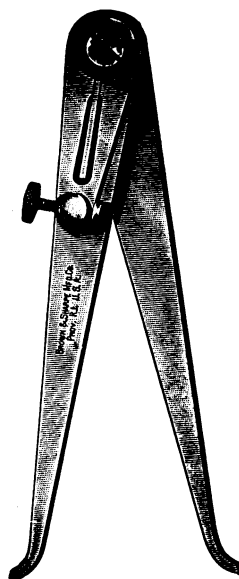
No.	Size.	Price.	No.	Size.	Price.
826	4"	\$1 10	827	4"	\$1 10
	5	1 25		5	1 25
	6	1 35		6	1 35
	8	1 60		8	1 60
	10	1 85		10	1 85
	12	2 10		12	2 10
	14	2 35		14	2 35
	16	2 60		16	2 60
	18	2 85		18	2 85
	20	3 35		20	3 35
	24	4 10		24	4 10

# Screw Adjusting Firm Joint Calipers.

**TEMPERED.**



**831**



**832**

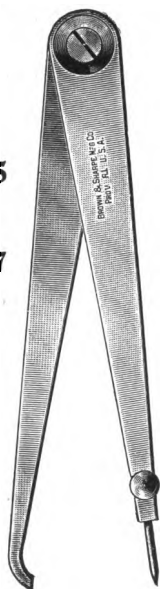
**OUTSIDE.**

**INSIDE.**

No.	Size.	Price.	No.	Size.	Price.
<b>831</b>	4"	\$0 90	<b>832</b>	4"	\$0 90
	5	95		5	95
	6	1 00		6	1 00
	8	1 25		8	1 25
	10	1 50		10	1 50
	12	1 75		12	1 75
	14	2 00		14	2 00
	16	2 25		16	2 25
	18	2 50		18	2 50
	20	2 75		20	2 75
	24	3 50		24	3 50

835

837



## Firm Joint Hermaphrodite Calipers.

### No. 835.

#### TEMPERED.

No.	Size.	Price with Adjustable Point.	Price with Solid Point.
<b>835</b>	4"	\$0 65	\$0 50
	6	80	65
	8	1 00	80

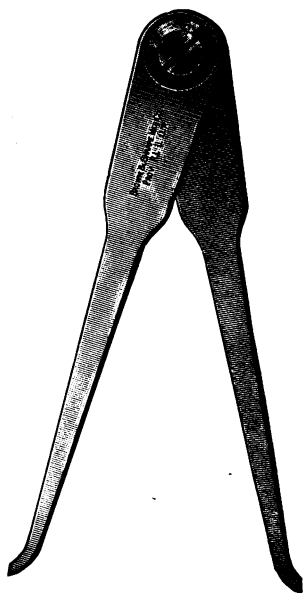
## Narrow Firm Joint Caliper, No. 837.

#### TEMPERED.

#### Price, \$0 60.

This Caliper is the same in design as the regular 4" Firm Joint Caliper, excepting that the legs are much narrower and allow it to be used to measure the diameter of deep holes at the bottom.

It can be inserted 2 1-2" in a hole 1-4" in diameter.

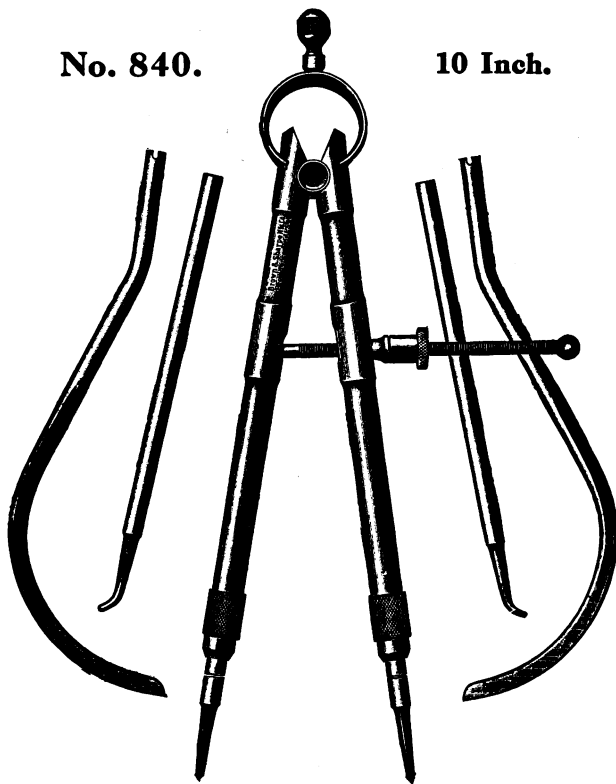


# Combination Caliper and Divider.

No. 840.

10 Inch.

840



This Combination Caliper and Divider is entirely new in design. The arms or holders are provided with split chucks to receive the auxiliary legs, which are held firmly by the simple turn of the knurled nut that closes the chuck concentrically. A pencil can be substituted for one of the legs if desired.

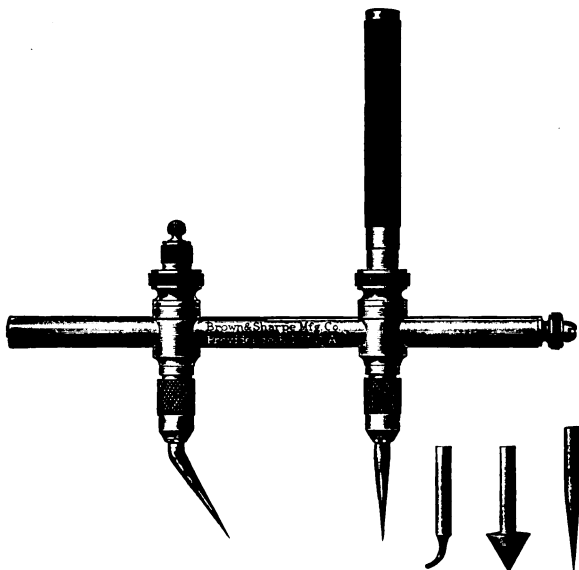
This tool is of steel carefully finished and sharp corners are practically eliminated.

## Prices.

Set Complete, . . . . .	\$3 00
With Divider Legs only, . . . . .	2 00

## Universal Dividers, No. 843.

843



**Price, \$3 00.**

This tool shows many points of excellence in design and construction.

The scribe point holder has both fine and quick adjustment; the fine adjustment is obtained by a screw, enclosed in the beam, which engages the nut on the scribe point holder. By pulling up the small knurled knob, at top of post, the screw is released and the post can be quickly adjusted; this knob springs into place as soon as released.

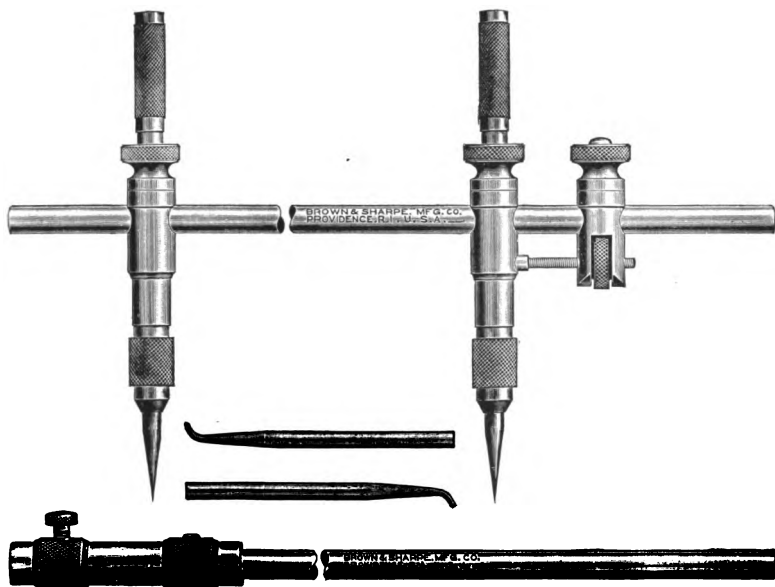
The scribe point is adjustable either side of the centre, and can be set for scribing small circles or for working close to a shoulder. The adjustable centre point is held by a spring chuck and can be removed easily and replaced by a pencil or other special points. The posts are clamped by knurled nuts and held in place by spring friction when the nuts are unclamped for setting the points.

A V point is furnished for use in describing a circle about a hole already drilled. A caliper point is also included.

The beam is 4" long and the points can be set to describe a circle 8" in diameter.

# Improved Steel Beam Trammels, No. 845.

845



**Price, with 9" Beam, \$3 00.**  
Will describe a circle 18" in dia.

**Price, with 13" Beam, \$3 00.**  
Will describe a circle 26" in dia.

**Price, with 13" Beam and Extension, \$3 50.**  
Will describe a circle 54" in dia.

The trams are clamped by knurled nuts to the beam, which is flattened on top, and the thrust taken by washers to prevent marring the bearing surfaces. A spring friction holds the trams in place when the nuts are loosened for setting. One tram has an adjusting screw and slide, which is convenient for fine adjustment of the points.

A swivel handle at the top of each tram is a noticeable advantage, as it enables the trammels to be much more conveniently and accurately used than is possible with fixed handles. The adjustable points are held by spring chucks and can be removed easily and replaced by pencil or other special points.

A pair of caliper points is furnished with these trammels.

A pair of V points, one large and one small, together covering a range of 1-4" to 1 5-8" diameter can be furnished if desired. Price, \$1 00 extra.

# Set of Standard Tools, No. 847.

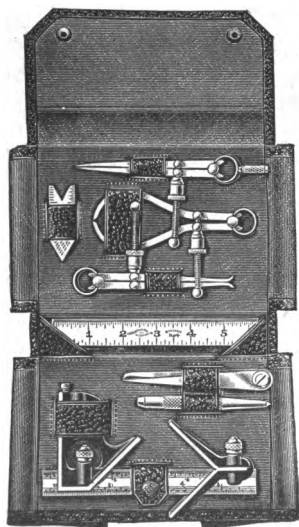
FOR STUDENTS AND APPRENTICES.

847



**Price, \$6 00.**

This set includes tools that the experience of the shop man has proved to be essential to the equipment of the beginner.



It is neatly arranged in a folding leather case as shown in the cuts. Size folded, about 7" x 4 3-4" x 1 3-8"

## Contains the following tools.

- No. 300—6" Tempered Steel Rule,  
No. 4 Graduation.
- No. 402—6" Combination Square,  
No. 4 Graduation,  
(with drop forged heads.)
- No. 650—60° Centre Gauge.
- No. 765—9-64" Centre Punch.
- No. 810—4" Rex Divider, solid nut.
- No. 811—4" Rex Outside Caliper,  
solid nut.
- No. 812—4" Rex Inside Caliper,  
solid nut.
- No. 835—4" Hermaphrodite Caliper,  
solid point.



# Set of Standard Tools, No. 849,

FOR STUDENTS AND APPRENTICES.

849



**Price, \$6 15.**

This set of standard tools is furnished in a nicely finished wooden box.

The "Handbook for Apprenticed Machinists" included with the set, contains many useful hints and instructions in the proper way to perform a large variety of operations common to machine shop practice.

## Contains the following tools:

No. 300—6" Tempered Steel Rule,  
No. 4 Graduation.  
No. 402—6" Combination Square,  
No. 4 Graduation,  
(with drop forged heads.)  
No. 650—60° Centre Gauge.  
No. 765—Centre Punch,  
(9-64" at top of tapered point.)

No. 810—5" Rex Divider, solid nut.  
No. 811—6" Rex Outside Caliper,  
solid nut.  
No. 812—6" Rex Inside Caliper,  
solid nut.  
Handbook for Apprenticed Machinists.

## Gas Heater, No. 850.

**For Tempering Drills, Punches, Chisels, Small Tools, Etc.**

850

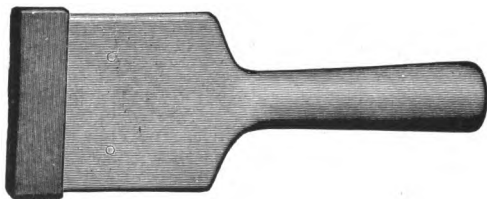


855

**Price, 75 Cents.**

This Heater, in many instances, takes the place of a forge in tempering machinists' small tools and is more convenient and economical in time and fuel. It is provided with a collar with holes corresponding to those in the lower part of the tube. By this arrangement the supply of air can be regulated and the intensity of the flame controlled.

## Rubber Tipped Foundry Rammer, No. 855.



The Foundry Rammer shown, has advantages over the rammer usually employed in foundries, in that it does not mar the pattern, whether it be of wood or metal and with it the mould can be made as hard as with the ordinary rammers.

The Rammer complete consists of a detachable wooden handle which we carry in the following lengths: 12", 38" and 50". On one end of the handle is an iron peen which is rubber tipped as shown in cut above, for use in ramming in narrow and difficult places. On the other end is a round iron butt for general work. The peen and butt are both detachable.

Price, complete, each, \$0 85; Rubber Tips, each \$0 15; in lots of not less than one dozen, \$1 50 per dozen.

We also carry in stock two small Rammers with iron handles measuring 36" and 50" long.

Price, complete, each, \$0 70; Rubber Tips, each, \$0 12; in lots of not less than one dozen, \$1 20 per dozen.

In ordering state the length of handle wanted.

## Publications.

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We issue the following copyrighted publications.

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### **Practical Treatise on Milling and Milling Machines.**

**Edition of 1916.**

This work is a thorough treatise on Milling and Milling Machines. 332 pages, 210 illustrations. Sent on receipt of price. Cloth, \$1.50. Cardboard, \$1.00.

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### **Construction and Use of Automatic Screw Machines.**

**Edition of 1916.**

This book is published to assist those who are not familiar with the construction and use of the Automatic Screw Machine. Sent on receipt of price. Cardboard, 50 cents.

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### **Construction and Use of Universal Grinding Machines.**

**Edition of 1916.**

This work describes the construction and use of Universal Grinding Machines, as made by us. Fully illustrated. Sent on receipt of price. Cardboard, 25 cents.

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### **Construction and Use of Plain Grinding Machines.**

**Edition of 1916.**

This work describes the construction and use of Plain Grinding Machines, made by us. Fully illustrated. Sent on receipt of price. Cardboard, 25 cents.

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### **Practical Treatise on Gearing.**

**Edition of 1915.**

This book, with its tables and illustrations, is written for those in practical life, who wish to obtain practical explanations and directions in making Gear Wheels. Sent on receipt of price. Cloth, \$1.00; Cardboard, 75 cents.

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### **Formulas in Gearing.**

**Edition of 1913.**

This work supplements the "Practical Treatise on Gearing," and contains formulas for solving the problems that occur in gearing. Sent on receipt of price. Cloth, \$1.50.

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### **Handbook for Apprenticed Machinists.**

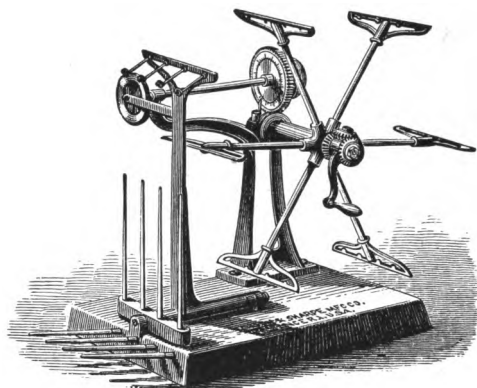
This book, illustrated, is for the Apprenticed Machinist. It is carefully written to assist the learner in the use of Machine Tools. Sent on receipt of price. Cloth, 50 cents.

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## Yarn Reel, No. 975.

**For Reeling and Measuring Lengths of Cotton, Woolen and  
Worsted Yarns.**

**975**



**Price, \$25 00.**

The cut illustrates a Yarn Reel specially adapted for accurate reeling of fine yarns. It is used in connection with Roving Scales and Yarn Testers when obtaining the stretch, strength and number of cotton, woolen and worsted yarns.

The Reels are made with four or seven spindles and in two sizes, 36" and 54" in circumference.

The dial of the 36" reel is graduated into 80 parts, that of the 54" reel is graduated into 120 parts, indicating the number of yards reeled from each spindle. The yarn guides and spindles are kept in line with each other while feeding yarn upon the reel, which is very desirable when reeling fine yarns. The extra length of yarn guides is of use in increasing the friction upon the yarn by taking a half turn or more of yarn around them. The automatic feed motion lays the yarn flat upon the reel, thus securing accurate and uniform measurement and consequently correct results as to stretch, strength and numbering.

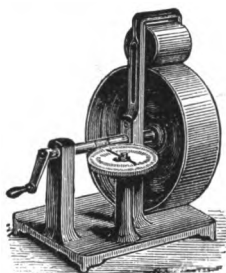
The bright spot on the web of the worm wheel is to show when the zero upon the dial approaches the index point, and thus assists the operator to stop promptly on the striking of the bell.

Printed tables are sent for use in connection with this reel, for numbering cotton, linen, woolen and worsted yarns.

## Roving Reel, No. 977.

To Accompany the Roving or Yarn Scales.

977



Price, \$14 00.

For reeling small quantities of roving, drawing and yarn and also to determine the number of twist in yarn.

Circumference of large drum, 18".

### Instructions for Use with the Yarn Reel.

**To Find Number of Cotton Yarn.** Reel and weigh any convenient number of yards. Multiply number of yards reeled by 8 1-3, and divide product by weight of sample in grains. Quotient will be number of the yarn, or number of hanks in a pound Avoirdupois.

**To Find Number of Linen Yarn.** Reel and weigh any convenient number of yards. Multiply number of yards reeled by 23 1-3, and divide product by weight of sample in grains. Quotient will be number of the yarn, or number of leas in a pound Avoirdupois.

**To Find Number of Worsted Yarn.** Reel and weigh any convenient number of yards. Multiply number of yards reeled by 12 1-2, and divide product by weight of sample in grains. Quotient will be number of the yarn, or number of hanks in a pound Avoirdupois.

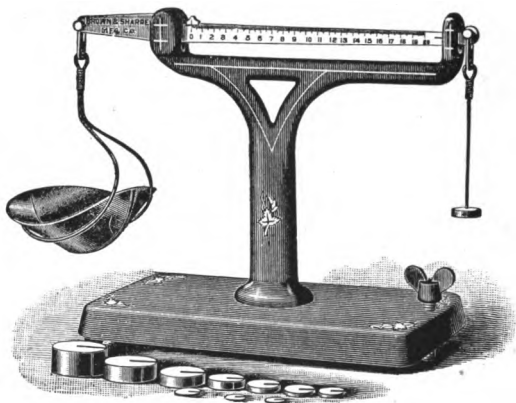
**To Find Number of Woolen Yarn.** Reel and weigh any convenient number of yards. Multiply number of yards reeled by 4 3-8, and divide product by weight of sample in grains. Quotient will be number of the yarn, or number of runs in a pound Avoirdupois.

**NOTE.** In all of above calculations, the longer the length of yarn taken, the more accurate the result will be.

# Improved Roving or Yarn Scales, No. 980.

**For Accurate Weighing.**

**980**



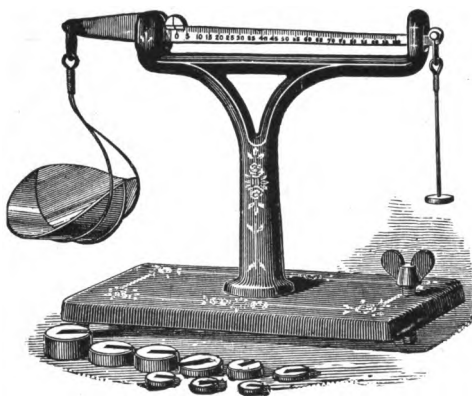
**Price, \$10 00.**

These scales will weigh one pound by tenths of grains or one seventy-thousandth part of one pound avoirdupois, rendering them especially well adapted for use in connection with Yarn Reels, for the numbering of yarn from the weight of hank, giving the weight in tenths of grains to compare with tables. They are also useful for the weighing of any small articles, colors, drugs, etc., for computation of large quantities, or for postal scales. The finished parts are nickel-plated and the stand japanned and ornamented. A spirit level is placed in centre of base, for the purpose of setting the scales true on a bench or table. Ten balancing weights accompany each scale, viz.: One each of 20, 30, 50, 100, 200, 300, 500, 1000, 2000 and 3000 grains; the 20 grains on the beam being each divided into 10 parts.

One pound avoirdupois	=	7000	grains.
1-2    "        "	=	3500	"
1-4    "        "	=	1750	"
1-8    "        "	=	875	"
One ounce        "	=	437-5	"

# Sample Weighing Scales, No. 982.

982



**ENGLISH—Weighs to one ten-thousandth lb.**

**METRIC—Weighs to one one-hundredth gramme.**

**Price, \$10 00.**

These scales will weigh one pound by ten-thousandths of a pound. They are well adapted for weighing small articles, screws, samples of paper, color, drugs, etc., for the purpose of computing large quantities. They also answer as postal scales. The finished parts are all nickel-plated, and the stand is japanned and ornamented. A spirit level is placed in centre of base, for the purpose of setting the scales true on a bench or table. Nine balancing weights accompany the scales, viz.: One each respectively of 100, 200, 400, 800, 1000 2000, 2000, 4000 ten-thousandths, and also one ounce weight for postage weighing.

7000 grains equal one pound avoirdupois.

One ten-thousandth of a pound equals 7-10 of a grain.

156	1-4	"	"	"	"	"	1-4	of an ounce.
312	1-2	"	"	"	"	"	1-2	" " "
468	3-4	"	"	"	"	"	3-4	" " "
625	"	"	"	"	"	"	1	
2500	"	"	"	"	"	"	1-4	of a pound.
5000	"	"	"	"	"	"	1-2	" " "
7500	"	"	"	"	"	"	3-4	" " "

We also make scales to weigh by the metric system to 1-100 gramme. Weights, 1, 2, 5, 10, 20, 40, 60, 100, 100 and 200 grammes.

# Decimal Equivalents

## Of Parts of an Inch.

$\frac{1}{8}$	.01563	$\frac{11}{16}$	.32813	$\frac{43}{64}$	.70313
$\frac{1}{8}$	.03125	$\frac{3}{4}$	.34375	$\frac{23}{32}$	.71875
$\frac{3}{16}$	.04688	$\frac{5}{8}$	.35938	$\frac{47}{64}$	.73438
$\frac{1}{4}$	.0625	$\frac{3}{8}$	.375	$\frac{3}{4}$	.75
$\frac{5}{16}$	.07813	$\frac{1}{2}$	.39063	$\frac{49}{64}$	.76563
$\frac{3}{8}$	.09375	$\frac{5}{8}$	.40625	$\frac{25}{32}$	.78125
$\frac{7}{16}$	.10938	$\frac{3}{4}$	.42188	$\frac{51}{64}$	.79688
$\frac{1}{2}$	.125	$\frac{7}{16}$	.4375	$\frac{13}{16}$	.8125
$\frac{9}{16}$	.14063	$\frac{1}{2}$	.45313	$\frac{53}{64}$	.82813
$\frac{5}{8}$	.15625	$\frac{5}{8}$	.46875	$\frac{27}{32}$	.84375
$\frac{11}{16}$	.17188	$\frac{3}{4}$	.48438	$\frac{55}{64}$	.85938
$\frac{3}{4}$	.1875	$\frac{1}{2}$	.5	$\frac{7}{8}$	.875
$\frac{13}{16}$	.20313	$\frac{5}{8}$	.51563	$\frac{57}{64}$	.89063
$\frac{7}{8}$	.21875	$\frac{11}{16}$	.53125	$\frac{29}{32}$	.90625
$\frac{15}{16}$	.23438	$\frac{3}{4}$	.54688	$\frac{59}{64}$	.92188
$\frac{1}{4}$	.25	$\frac{9}{16}$	.5625	$\frac{15}{16}$	.9375
$\frac{17}{16}$	.26563	$\frac{5}{8}$	.57813	$\frac{61}{64}$	.95313
$\frac{9}{8}$	.28125	$\frac{11}{16}$	.59375	$\frac{31}{32}$	.96875
$\frac{19}{16}$	.29688	$\frac{3}{4}$	.60938	$\frac{63}{64}$	.98438
$\frac{5}{4}$	.3125	$\frac{5}{8}$	.625	1	1.00000
		$\frac{11}{16}$	.64063		
		$\frac{3}{4}$	.65625		
		$\frac{13}{16}$	.67188		
		$\frac{11}{16}$	.6875		



## Millimetre Equivalents Of Parts of an Inch.

$\frac{1}{8}$	$\frac{1}{8}$	.397	$\frac{1}{4}$	$\frac{1}{4}$	8.334	$\frac{1}{2}$	$\frac{1}{2}$	17.859
$\frac{1}{4}$	$\frac{1}{4}$	.794	$\frac{3}{8}$	$\frac{3}{8}$	8.731	$\frac{5}{8}$	$\frac{5}{8}$	18.256
$\frac{3}{8}$	$\frac{3}{8}$	1.191	$\frac{1}{2}$	$\frac{1}{2}$	9.128	$\frac{7}{8}$	$\frac{7}{8}$	18.653
$\frac{1}{2}$	$\frac{1}{2}$	1.587	$\frac{5}{8}$	$\frac{5}{8}$	9.525	$\frac{15}{16}$	$\frac{15}{16}$	19.050
$\frac{5}{8}$	$\frac{5}{8}$	1.984	$\frac{3}{4}$	$\frac{3}{4}$	9.922	$\frac{13}{16}$	$\frac{13}{16}$	19.447
$\frac{3}{4}$	$\frac{3}{4}$	2.381	$\frac{7}{8}$	$\frac{7}{8}$	10.319	$\frac{11}{8}$	$\frac{11}{8}$	19.844
$\frac{7}{8}$	$\frac{7}{8}$	2.778	$\frac{15}{16}$	$\frac{15}{16}$	10.716	$\frac{23}{16}$	$\frac{23}{16}$	20.240
$\frac{15}{16}$	$\frac{15}{16}$	3.175	$\frac{1}{8}$	$\frac{1}{8}$	11.113	$\frac{9}{8}$	$\frac{9}{8}$	20.637
$\frac{1}{8}$	$\frac{1}{8}$	3.572	$\frac{1}{4}$	$\frac{1}{4}$	11.509	$\frac{5}{4}$	$\frac{5}{4}$	21.034
$\frac{1}{4}$	$\frac{1}{4}$	3.969	$\frac{3}{8}$	$\frac{3}{8}$	11.906	$\frac{3}{2}$	$\frac{3}{2}$	21.431
$\frac{3}{8}$	$\frac{3}{8}$	4.366	$\frac{1}{2}$	$\frac{1}{2}$	12.303	$\frac{7}{4}$	$\frac{7}{4}$	21.828
$\frac{1}{2}$	$\frac{1}{2}$	4.762	$\frac{5}{8}$	$\frac{5}{8}$	12.700	$\frac{15}{8}$	$\frac{15}{8}$	22.225
$\frac{5}{8}$	$\frac{5}{8}$	5.159	$\frac{3}{4}$	$\frac{3}{4}$	13.097	$\frac{17}{8}$	$\frac{17}{8}$	22.622
$\frac{3}{4}$	$\frac{3}{4}$	5.556	$\frac{7}{8}$	$\frac{7}{8}$	13.494	$\frac{9}{4}$	$\frac{9}{4}$	23.019
$\frac{7}{8}$	$\frac{7}{8}$	5.953	$\frac{15}{16}$	$\frac{15}{16}$	13.890	$\frac{19}{8}$	$\frac{19}{8}$	23.415
$\frac{15}{16}$	$\frac{15}{16}$	6.350	$\frac{1}{8}$	$\frac{1}{8}$	14.287	$\frac{21}{8}$	$\frac{21}{8}$	23.812
$\frac{1}{8}$	$\frac{1}{8}$	6.747	$\frac{1}{4}$	$\frac{1}{4}$	14.684	$\frac{23}{8}$	$\frac{23}{8}$	24.209
$\frac{1}{4}$	$\frac{1}{4}$	7.144	$\frac{3}{8}$	$\frac{3}{8}$	15.081	$\frac{25}{8}$	$\frac{25}{8}$	24.606
$\frac{3}{8}$	$\frac{3}{8}$	7.541	$\frac{1}{2}$	$\frac{1}{2}$	15.478	$\frac{27}{8}$	$\frac{27}{8}$	25.003
$\frac{1}{2}$	$\frac{1}{2}$	7.937	$\frac{5}{8}$	$\frac{5}{8}$	15.875	$\frac{29}{8}$	$\frac{29}{8}$	25.400
			$\frac{3}{4}$	$\frac{3}{4}$	16.272			
			$\frac{7}{8}$	$\frac{7}{8}$	16.669			
			$\frac{15}{16}$	$\frac{15}{16}$	17.065			
			$\frac{1}{8}$	$\frac{1}{8}$	17.462			

# Decimal Equivalents

## Of Millimetres and Fractions of Millimetres.

m/m.	Inches.	m/m.	Inches.	m/m.	Inches.	m/m.	Inches.
$\frac{1}{100} =$	.00039	$\frac{88}{100} =$	.01299	$\frac{64}{100} =$	.02520	$\frac{95}{100} =$	.03740
$\frac{2}{100} =$	.00079	$\frac{89}{100} =$	.01339	$\frac{65}{100} =$	.02559	$\frac{96}{100} =$	.03780
$\frac{3}{100} =$	.00118	$\frac{90}{100} =$	.01378	$\frac{66}{100} =$	.02598	$\frac{97}{100} =$	.03819
$\frac{4}{100} =$	.00157	$\frac{91}{100} =$	.01417	$\frac{67}{100} =$	.02638	$\frac{98}{100} =$	.03858
$\frac{5}{100} =$	.00197	$\frac{92}{100} =$	.01457	$\frac{68}{100} =$	.02677	$\frac{99}{100} =$	.03898
$\frac{6}{100} =$	.00236	$\frac{93}{100} =$	.01496	$\frac{69}{100} =$	.02717	1 =	.03937
$\frac{7}{100} =$	.00276	$\frac{94}{100} =$	.01535	$\frac{70}{100} =$	.02756	2 =	.07874
$\frac{8}{100} =$	.00315	$\frac{95}{100} =$	.01575	$\frac{71}{100} =$	.02795	3 =	.11811
$\frac{9}{100} =$	.00354	$\frac{96}{100} =$	.01614	$\frac{72}{100} =$	.02835	4 =	.15748
$\frac{10}{100} =$	.00394	$\frac{97}{100} =$	.01654	$\frac{73}{100} =$	.02874	5 =	.19685
$\frac{11}{100} =$	.00433	$\frac{98}{100} =$	.01693	$\frac{74}{100} =$	.02913	6 =	.23622
$\frac{12}{100} =$	.00472	$\frac{99}{100} =$	.01732	$\frac{75}{100} =$	.02953	7 =	.27559
$\frac{13}{100} =$	.00512	$\frac{45}{100} =$	.01772	$\frac{76}{100} =$	.02992	8 =	.31496
$\frac{14}{100} =$	.00551	$\frac{46}{100} =$	.01811	$\frac{77}{100} =$	.03032	9 =	.35433
$\frac{15}{100} =$	.00591	$\frac{47}{100} =$	.01850	$\frac{78}{100} =$	.03071	10 =	.39370
$\frac{16}{100} =$	.00630	$\frac{48}{100} =$	.01890	$\frac{79}{100} =$	.03110	11 =	.43307
$\frac{17}{100} =$	.00669	$\frac{49}{100} =$	.01929	$\frac{80}{100} =$	.03150	12 =	.47244
$\frac{18}{100} =$	.00709	$\frac{50}{100} =$	.01969	$\frac{81}{100} =$	.03189	13 =	.51181
$\frac{19}{100} =$	.00748	$\frac{51}{100} =$	.02008	$\frac{82}{100} =$	.03228	14 =	.55118
$\frac{20}{100} =$	.00787	$\frac{52}{100} =$	.02047	$\frac{83}{100} =$	.03268	15 =	.59055
$\frac{21}{100} =$	.00827	$\frac{53}{100} =$	.02087	$\frac{84}{100} =$	.03307	16 =	.62992
$\frac{22}{100} =$	.00866	$\frac{54}{100} =$	.02126	$\frac{85}{100} =$	.03346	17 =	.66929
$\frac{23}{100} =$	.00906	$\frac{55}{100} =$	.02165	$\frac{86}{100} =$	.03386	18 =	.70866
$\frac{24}{100} =$	.00945	$\frac{56}{100} =$	.02205	$\frac{87}{100} =$	.03425	19 =	.74803
$\frac{25}{100} =$	.00984	$\frac{57}{100} =$	.02244	$\frac{88}{100} =$	.03465	20 =	.78740
$\frac{26}{100} =$	.01024	$\frac{58}{100} =$	.02283	$\frac{89}{100} =$	.03504	21 =	.82677
$\frac{27}{100} =$	.01063	$\frac{59}{100} =$	.02323	$\frac{90}{100} =$	.03543	22 =	.86614
$\frac{28}{100} =$	.01102	$\frac{60}{100} =$	.02362	$\frac{91}{100} =$	.03583	23 =	.90551
$\frac{29}{100} =$	.01142	$\frac{61}{100} =$	.02402	$\frac{92}{100} =$	.03622	24 =	.94488
$\frac{30}{100} =$	.01181	$\frac{62}{100} =$	.02441	$\frac{93}{100} =$	.03661	25 =	.98425
$\frac{31}{100} =$	.01220	$\frac{63}{100} =$	.02480	$\frac{94}{100} =$	.03701	26 =	1.02362
$\frac{32}{100} =$	.01260						

# Weights

## Of Square and Round Bars of Wrought Iron

IN POUNDS PER LINEAR FOOT.—*Kent.*

Iron weighing 480 lbs. per cubic foot. For Steel add 2 per cent.

Thickness or Diameter in Inches.	Weight of Square Bar One Foot Long	Weight of Round Bar One Foot Long	Thickness or Diameter in Inches.	Weight of Square Bar One Foot Long	Weight of Round Bar One Foot Long
0			2 1-2	20.83	16.86
1-16	.013	.010	9-16	21.89	17.19
1-8	.052	.041	5-8	22.97	18.04
3-16	.117	.092	11-16	24.08	18.91
1-4	.208	.164	3-4	25.21	19.80
5-16	.326	.256	13-16	26.37	20.71
3-8	.469	.368	7-8	27.55	21.64
7-16	.638	.501	15-16	28.76	22.59
1-2	.833	.654	3	30.00	23.56
9-16	1.055	.828	1-16	31.26	24.55
5-8	1.302	1.023	1-8	32.55	25.57
11-16	1.576	1.237	3-16	33.87	26.60
3-4	1.875	1.473	1-4	35.21	27.65
13-16	2.201	1.728	5-16	36.58	28.73
7-8	2.552	2.004	3-8	37.97	29.82
15-16	2.930	2.301	7-16	39.39	30.94
1	3.333	2.618	1-2	40.83	32.07
1-16	3.763	2.955	9-16	42.30	33.23
1-8	4.219	3.313	5-8	43.80	34.40
3-16	4.701	3.692	11-16	45.33	35.60
1-4	5.208	4.091	3-4	46.88	36.82
5-16	5.742	4.510	13-16	48.45	38.05
3-8	6.302	4.950	7-8	50.05	39.31
7-16	6.888	5.410	15-16	51.68	40.59
1-2	7.500	5.890	4	53.33	41.89
9-16	8.138	6.392	1-16	55.01	43.21
5-8	8.802	6.913	1-8	56.72	44.55
11-16	9.492	7.455	3-16	58.45	45.91
3-4	10.21	8.018	1-4	60.21	47.29
13-16	10.95	8.601	5-16	61.99	48.69
7-8	11.72	9.204	3-8	63.80	50.11
15-16	12.51	9.828	7-16	65.64	51.55
2	13.33	10.47	1-2	67.50	53.01
1-16	14.18	11.14	9-16	69.39	54.50
1-8	15.05	11.82	5-8	71.30	56.00
3-16	15.95	12.53	11-16	73.24	57.52
1-4	16.88	13.25	3-4	75.21	59.07
5-16	17.83	14.00	13-16	77.20	60.63
3-8	18.80	14.77	7-8	79.22	62.22
7-16	19.80	15.55	15-16	81.26	63.82

Continued on next page.

# Weights

## Of Square and Round Bars of Wrought Iron

IN POUNDS PER LINEAR FOOT.—*Kent.*

Iron weighing 480 lbs. per cubic foot. For Steel add 2 per cent.

Thickness or Diameter in Inches.	Weight of Square Bar One Foot Long	Weight of Round Bar One Foot Long	Thickness or Diameter in Inches.	Weight of Square Bar One Foot Long	Weight of Round Bar One Foot Long
5	83.33	65.45	7	163.3	128.3
1-16	85.43	67.10	1-8	169.2	132.9
1-8	87.55	68.76	1-4	175.2	137.6
3-16	89.70	70.45	3-8	181.3	142.4
1-4	91.88	72.16	1-2	187.5	147.3
5-16	94.08	73.89	5-8	193.8	152.2
3-8	96.30	75.64	3-4	200.2	157.2
7-16	98.55	77.40	7-8	206.7	162.4
1-2	100.8	79.19	8	213.3	167.6
9-16	103.1	81.00	1-4	226.9	178.2
5-8	105.5	82.83	1-2	240.8	189.2
11-16	107.8	84.69	3-4	255.2	200.4
3-4	110.2	86.56	9	270.0	212.1
13-16	112.6	88.45	1-4	285.2	224.0
7-8	115.1	90.36	1-2	300.8	236.3
15-16	117.5	92.29	3-4	316.9	248.9
6	120.0	94.25	10	333.3	261.8
1-8	125.1	98.22	1-4	350.2	275.1
1-4	130.2	102.3	1-2	367.5	288.6
3-8	135.5	106.4	3-4	385.2	302.5
1-2	140.8	110.6	11	403.3	316.8
5-8	146.3	114.9	1-4	421.9	331.3
3-4	151.9	119.3	1-2	440.8	346.2
7-8	157.6	123.7	3-4	460.2	361.4
			12	480.	377.

To compute the weight of Sheet Iron:

Multiply the thickness by 40; the result is the weight in pounds per square foot.

Example: A piece of Sheet Iron is .005" thick, its weight is  $.005 \times 40 = .200$  lbs. per square foot.

To compute the weight of Sheet Steel:

Multiply the thickness by 40.8; the result is the weight in pounds per square foot.

Example: A piece of Sheet Steel is .005" thick, its weight is  $.005 \times 40.8 = .204$  lbs. per square foot.

# Weight of Iron and Steel Sheets.

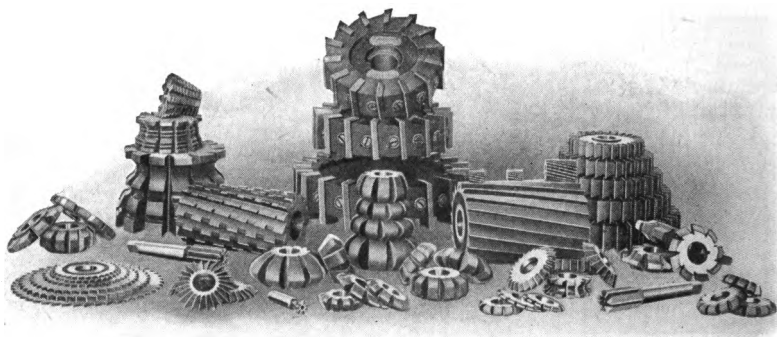
Weight per Square Foot.—*Kent.*

Thickness by Birmingham Gauge.				Thickness by American (Brown & Sharpe's) Gauge.			
No. of Gauge.	Thickness in Inches.	Iron.	Steel.	No. of Gauge.	Thickness in Inches.	Iron.	Steel.
0000	.454	18.16	18.52	0000	.46	18.40	18.77
000	.425	17.00	17.34	000	.4096	16.38	16.71
00	.38	15.20	15.30	00	.3648	14.59	14.88
0	.34	13.60	13.87	0	.3249	13.00	13.26
1	.3	12.00	12.24	1	.2893	11.57	11.80
2	.284	11.36	11.59	2	.2576	10.30	10.51
3	.259	10.36	10.57	3	.2294	9.18	9.36
4	.238	9.52	9.71	4	.2043	8.17	8.34
5	.22	8.80	8.98	5	.1819	7.28	7.42
6	.203	8.12	8.28	6	.1620	6.48	6.61
7	.18	7.20	7.34	7	.1443	5.77	5.89
8	.165	6.60	6.73	8	.1285	5.14	5.24
9	.148	5.92	6.04	9	.1144	4.58	4.67
10	.134	5.36	5.47	10	.1019	4.08	4.16
11	.12	4.80	4.90	11	.0907	3.63	3.70
12	.109	4.36	4.45	12	.0808	3.23	3.30
13	.095	3.80	3.88	13	.0720	2.88	2.94
14	.083	3.32	3.39	14	.0641	2.56	2.62
15	.072	2.88	2.94	15	.0571	2.28	2.33
16	.065	2.60	2.65	16	.0508	2.03	2.07
17	.058	2.32	2.37	17	.0453	1.81	1.85
18	.049	1.96	2.00	18	.0403	1.61	1.64
19	.042	1.68	1.71	19	.0359	1.44	1.46
20	.035	1.40	1.43	20	.0320	1.28	1.31
21	.032	1.28	1.31	21	.0285	1.14	1.16
22	.028	1.12	1.14	22	.0253	1.01	1.03
23	.025	1.00	1.02	23	.0226	.904	.922
24	.022	.88	.898	24	.0201	.804	.820
25	.02	.80	.816	25	.0179	.716	.730
26	.018	.72	.734	26	.0159	.636	.649
27	.016	.64	.653	27	.0142	.568	.579
28	.014	.56	.571	28	.0126	.504	.514
29	.013	.52	.530	29	.0113	.452	.461
30	.012	.48	.490	30	.0100	.400	.408
31	.01	.40	.408	31	.0089	.356	.363
32	.009	.36	.367	32	.0080	.320	.326
33	.008	.32	.326	33	.0071	.284	.290
34	.007	.28	.286	34	.0063	.252	.257
35	.005	.20	.204	35	.0056	.224	.228

	Iron.	Steel.
Specific gravity . . . . .	7.7	7.854
Weight per cubic foot . . . . .	480.	489.6
Weight per cubic inch . . . . .	.2778	.2833

As there are many gauges in use differing from each other and even the thicknesses of a certain specified gauge, as the Birmingham, are not assumed the same by all manufacturers, orders for sheets and wires should always state the weight per square foot or the thickness in thousandths of an inch.

## Cutters.



We now regularly manufacture and usually carry in stock 45 varieties and nearly 5000 different sizes of Cutters and we can make any size or shape or arrange for any combination of cutters that may be desired.

Our Cutter Department is equipped with special machinery and many appliances that are the outgrowth of nearly 40 years experience in the manufacture of this class of tools.

Stocks of our regular cutters are carried by the leading hardware dealers throughout the country and can usually be purchased most advantageously from the dealers. It is also frequently advantageous to order Special Cutters through the dealers.

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## Lubricant.

With all of our Cutters lubricant should be freely used when milling Wrought Iron or Steel. Lard oil is usually the best; but, in many cases, the following Soda Water mixture answers very well and is less expensive:

One-quarter pound Sal-Soda. One-half pint Lard Oil. One-half pint Soft Soap. Water enough to make ten quarts. Boil one-half hour.

## The Advantages of Coarse Tooth Milling Cutters.

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In the development of Coarse Tooth Milling Cutters the aim has been to obtain the freest possible cutting action without impairing the accuracy of the surface produced. The new cutters with wide spaced teeth have a marked advantage, on many classes of work, over the usual types, being capable of removing a considerably greater quantity of metal in a given time, without distressing the cutter or overloading the machine.

The free cutting action of coarse tooth cutters is largely due to the fact that less cutting is actually required to remove a given amount of metal, each tooth taking a large, deep chip. This results in a considerable decrease in the tendency to slide over the surface and spring the cutter arbor. The rake and increased spiral of the teeth give a more nearly perfect shearing, rather than a pushing or dragging action. Accordingly there is less friction generated for a given cut, leaving the teeth much cooler and causing them to do considerably more work between grindings.

A marked advantage arising from the free cutting action is the consumption of less power, as might be expected from the fact that there is less friction and heating.

The wide spaces between the teeth allow the cutting edges to be well backed up, which was not always possible with closely spaced teeth. This increase in the strength of the teeth is much greater in proportion than the increase in work done by each tooth in removing the larger chips. Therefore the cutters are well prepared to handle deep and rapid cuts without danger of failing.

The main advantage of Coarse Tooth Milling Cutters may then be stated as increased production and decreased power consumption due to the heavier cuts taken and the freer cutting action. Of course, the amount of improvement in these points differs greatly in various instances owing to the conditions, such as the stiffness of the work, nature of the cut, strength of the machine, etc.

In developing the line of Brown & Sharpe Coarse Tooth Milling Cutters, particular attention has been given to the angle of rake and the lead of the spiral of the teeth. After a long series of practical experiments we have adopted the present type with steep spiral and considerable angle of rake as the most economical and practical form.

# Table of Cutting Speeds.

Feet per Minute.	15	17.5	20	22.5	25	27.5	30	35	40	45	50	55
Diam.	REVOLUTIONS PER MINUTE.											
1/16	917	1070	1222	1375	1528	1681	1833	2139	2445	2750	3056	3361
1/8	458	535	611	688	764	840	917	1070	1222	1375	1528	1681
3/16	306	357	407	458	509	560	611	713	815	917	1019	1120
1/4	229	267	306	344	382	420	458	535	611	688	764	840
5/16	183	214	244	275	306	336	367	428	489	550	611	672
3/8	153	178	204	229	255	280	306	357	407	458	509	560
7/16	131	153	175	196	218	240	262	306	349	393	437	480
1/2	115	134	153	172	191	210	229	267	306	344	382	420
5/8	91.7	107	122	138	153	168	183	214	244	275	306	336
3/4	76.4	89.1	102	115	127	140	153	178	204	229	255	280
7/8	65.5	76.4	87.3	98.2	109	120	131	153	175	196	218	240
1	57.3	66.8	76.4	85.9	95.5	105	115	134	153	172	191	210
1 1/8	50.9	59.4	67.9	76.4	84.9	93.4	102	119	136	153	170	187
1 1/4	45.8	53.5	61.1	68.8	76.4	84.0	91.7	107	122	138	153	168
1 3/8	41.7	48.6	55.6	62.5	69.5	76.4	83.3	97.2	111	125	139	153
1 1/2	38.2	44.6	50.9	57.3	63.7	70.0	76.4	89.1	102	115	127	140
1 5/8	35.3	41.1	47.0	52.9	58.8	64.6	70.5	82.3	94.0	106	118	129
1 3/4	32.7	38.2	43.7	49.1	54.6	60.0	65.5	76.4	87.3	98.2	109	120
1 7/8	30.6	35.7	40.7	45.8	50.9	56.0	61.1	71.3	81.5	91.7	102	112
2	28.7	33.4	38.2	43.0	47.7	52.5	57.3	66.8	76.4	85.9	95.5	105
2 1/4	25.5	29.7	34.0	38.2	42.4	46.7	50.9	59.4	67.9	76.4	84.9	93.4
2 1/2	22.9	26.7	30.6	34.4	38.2	42.0	45.8	53.5	61.1	68.8	76.4	84.0
2 3/4	20.8	24.3	27.8	31.3	34.7	38.2	41.7	48.6	55.6	62.5	69.5	76.4
3	19.1	22.3	25.5	28.6	31.8	35.0	38.2	44.6	50.9	57.3	63.7	70.0
3 1/4	17.6	20.6	23.5	26.4	29.4	32.3	35.3	41.1	47.0	52.9	58.8	64.6
3 1/2	16.4	19.1	21.8	24.5	27.3	30.0	32.7	38.2	43.7	49.1	54.6	60.0
3 3/4	15.3	17.8	20.4	22.9	25.5	28.0	30.6	35.7	40.7	45.8	50.9	56.0
4	14.3	16.7	19.1	21.5	23.9	26.3	28.7	33.4	38.2	43.0	47.7	52.5
4 1/2	12.7	14.9	17.0	19.1	21.2	23.3	25.5	29.7	34.0	38.2	42.4	46.7
5	11.5	13.4	15.3	17.2	19.1	21.0	22.9	26.7	30.6	34.4	38.2	42.0
5 1/2	10.4	12.2	13.9	15.6	17.4	19.1	20.8	24.3	27.8	31.3	34.7	38.2
6	9.5	11.1	12.7	14.3	15.9	17.5	19.1	22.3	25.5	28.6	31.8	35.0
6 1/2	8.8	10.3	11.8	13.2	14.7	16.2	17.6	20.6	23.5	26.4	29.4	32.3
7	8.2	9.5	10.9	12.3	13.6	15.0	16.4	19.1	21.8	24.5	27.3	30.0
7 1/2	7.6	8.9	10.2	11.5	12.7	14.0	15.3	17.8	20.4	22.9	25.5	28.0
8	7.2	8.4	9.5	10.7	11.9	13.1	14.3	16.7	19.1	21.5	23.9	26.3
8 1/2	6.7	7.9	9.0	10.1	11.2	12.4	13.5	15.7	18.0	20.2	22.5	24.7
9	6.4	7.4	8.5	9.5	10.6	11.7	12.7	14.9	17.0	19.1	21.2	23.3
9 1/2	6.0	7.0	8.0	9.1	10.1	11.1	12.1	14.1	16.1	18.1	20.1	22.1
10	5.7	6.7	7.6	8.6	9.5	10.5	11.5	13.4	15.3	17.2	19.1	21.0
11	5.2	6.1	6.9	7.8	8.7	9.5	10.4	12.2	13.9	15.6	17.4	19.1
12	4.8	5.6	6.4	7.2	8.0	8.8	9.5	11.1	12.7	14.3	15.9	17.5
13	4.4	5.1	5.9	6.6	7.3	8.1	8.8	10.3	11.8	13.2	14.7	16.2
14	4.1	4.8	5.5	6.1	6.8	7.5	8.2	9.5	10.9	12.3	13.6	15.0
15	3.8	4.5	5.1	5.7	6.4	7.0	7.6	8.9	10.2	11.5	12.7	14.0
16	3.6	4.2	4.8	5.4	6.0	6.6	7.2	8.4	9.5	10.7	11.9	13.1
17	3.4	3.9	4.5	5.1	5.6	6.2	6.7	7.9	9.0	10.1	11.2	12.4
18	3.2	3.7	4.2	4.8	5.3	5.8	6.4	7.4	8.5	9.5	10.6	11.7
Feet per Minute.	15	17.5	20	22.5	25	27.5	30	35	40	45	50	55



## Table of Cutting Speeds (Cont.)

Feet per Minute.	60	65	70	75	80	90	100	110	120	130	140	150
Diam.	REVOLUTIONS PER MINUTE.											
1/16	3667	3973	4278	4584	4889							
1/8	1833	1986	2139	2292	2445	2750	3056	3361	3667	3973	4278	4584
3/16	1222	1324	1426	1528	1630	1833	2037	2241	2445	2648	2852	3056
1/4	917	993	1070	1146	1222	1375	1528	1681	1833	1986	2139	2292
5/16	733	794	856	917	978	1100	1222	1345	1467	1589	1711	1833
3/8	611	662	713	764	815	917	1019	1120	1222	1324	1426	1528
7/16	524	568	611	655	698	786	873	960	1048	1135	1222	1310
1/2	458	497	535	573	611	688	764	840	917	993	1070	1146
5/8	367	397	428	458	489	550	611	672	733	794	856	917
3/4	306	331	357	382	407	458	509	560	611	662	713	764
7/8	262	284	306	327	349	393	437	480	524	568	611	655
1	229	248	267	287	306	344	382	420	458	497	535	573
1 1/16	204	221	238	255	272	306	340	373	407	441	475	509
1 1/4	183	199	214	229	244	275	306	336	367	397	428	458
1 3/8	167	181	194	208	222	250	278	306	333	361	389	417
1 1/2	153	166	178	191	204	229	255	280	306	331	357	382
1 5/8	141	153	165	176	188	212	235	259	282	306	329	353
1 3/4	131	142	153	164	175	196	218	240	262	284	306	327
1 7/8	122	132	143	153	163	183	204	224	244	265	285	306
2	115	124	134	143	153	172	191	210	229	248	267	287
2 1/4	102	110	119	127	136	153	170	187	204	221	238	255
2 1/2	91.7	99.3	107	115	122	138	153	168	183	199	214	229
2 3/4	83.3	90.3	97.2	104	111	125	139	153	167	181	194	208
3	76.4	82.8	89.1	95.5	102	115	127	140	153	166	178	191
3 1/4	70.5	76.4	82.3	88.2	94.0	106	118	129	141	153	165	176
3 1/2	65.5	70.9	76.4	81.9	87.3	98.2	109	120	131	142	153	164
3 3/4	61.1	66.2	71.3	76.4	81.5	91.7	102	112	122	132	143	153
4	57.3	62.1	66.8	71.6	76.4	85.9	95.5	105	115	124	134	143
4 1/2	50.9	55.2	59.4	63.6	67.9	76.4	84.9	93.4	102	110	119	127
5	45.8	49.7	53.5	57.3	61.1	68.8	76.4	84.0	91.7	99.3	107	115
5 1/2	41.7	45.1	48.6	52.1	55.6	62.5	69.5	76.4	83.8	90.3	97.2	104
6	38.2	41.4	44.6	47.8	50.9	57.3	63.7	70.0	76.4	82.8	89.1	95.5
6 1/2	35.3	38.2	41.1	44.1	47.0	52.9	58.8	64.6	70.5	76.4	82.3	88.2
7	32.7	35.5	38.2	40.9	43.7	49.1	54.6	60.0	65.5	70.9	76.4	81.9
7 1/2	30.6	33.1	35.7	38.2	40.7	45.8	50.9	56.0	61.1	66.2	71.3	76.4
8	28.7	31.0	33.4	35.8	38.2	43.0	47.7	52.5	57.3	62.1	66.8	71.6
8 1/2	27.0	29.2	31.5	33.7	36.0	40.4	44.9	49.4	53.9	58.4	62.9	67.4
9	25.5	27.6	29.7	31.8	34.0	38.2	42.4	46.7	50.9	55.2	59.4	63.6
9 1/2	24.1	26.1	28.2	30.2	32.2	36.2	40.2	44.2	48.3	52.3	56.3	60.3
10	22.9	24.8	26.7	28.7	30.6	34.4	38.2	42.0	45.8	49.7	53.5	57.3
11	20.8	22.6	24.3	26.0	27.8	31.3	34.7	38.2	41.7	45.1	48.6	52.1
12	19.1	20.7	22.3	23.9	25.5	28.6	31.8	35.0	38.2	41.4	44.6	47.8
13	17.6	19.1	20.6	22.0	23.5	26.4	29.4	32.3	35.3	38.2	41.1	44.1
14	16.4	17.7	19.1	20.5	21.8	24.5	27.3	30.0	32.7	35.5	38.2	40.9
15	15.3	16.6	17.8	19.1	20.4	22.9	25.5	28.0	30.6	33.1	35.7	38.2
16	14.3	15.5	16.7	17.9	19.1	21.5	23.9	26.3	28.7	31.0	33.4	35.8
17	13.5	14.6	15.7	16.9	18.0	20.2	22.5	24.7	27.0	29.2	31.5	33.7
18	12.7	13.8	14.9	15.9	17.0	19.1	21.2	23.3	25.5	27.6	29.7	31.8
Feet per Minute.	60	65	70	75	80	90	100	110	120	130	140	150

## Clearance on Cutters.

When sharpening cutters, the clearance should always be taken into consideration. Clearance, or relief, on milling cutters, is the amount of material removed from the top of the teeth back of the cutting edge, to permit the teeth to clear the stock and not scrape over it, after the cutting edge has done its work. On formed and gear cutters clearance does not have to be considered in re-sharpening, because the teeth are so formed that when ground radially on the faces the clearance remains the same.

The angle of clearance depends upon the diameter of the cutters, and must be greater for small cutters than for large ones. The clearance on the teeth of plain milling cutters should be 4 degrees for cutters over 3 inches in diameter, and 6 degrees for those under 3 inches, and the land at the top of the teeth should be from .02 to .04 inches wide, before the clearance is cut or ground. The clearance of the end teeth of end mills should be about 2 degrees, and it is well to have the teeth a little hollowing, letting them be .001" or .002" lower near the centre than at the outside so that the inner ends of the teeth will not drag on the work. This can be done by setting the swivel on the cutter grinder slightly away from 90 degrees. If the clearance of a cutter is too great, vibrations are likely to occur in operation, and this is something that should be prevented by all means.

See Cutter Clearance Gauge on page 354.

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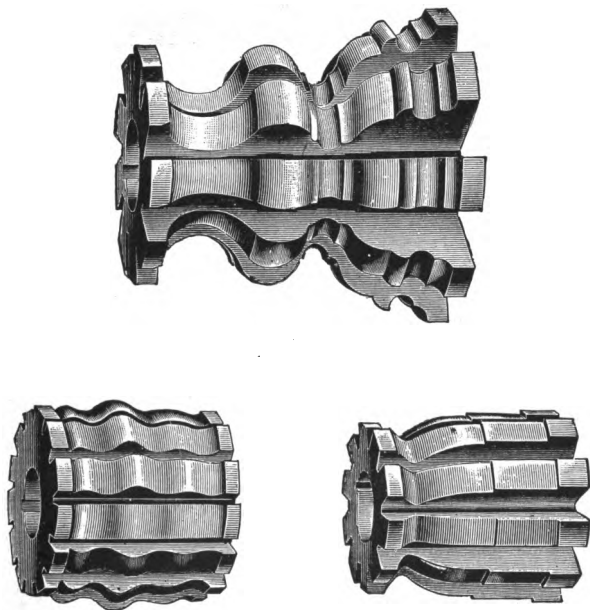
## Feeds and Speeds.

The Feeds and Speeds of Cutters cannot be governed by any definite rules, but, in a general way the following surface speeds will serve to give an idea, or basis to work from. They may be varied slightly to suit the requirements of the work in hand. Using Carbon Steel Cutters: For brass, 80 feet to 100 feet per minute; for cast iron, 40 feet to 60 feet per minute; for machinery steel, 30 feet to 40 feet per minute; and for annealed tool steel, 20 feet to 30 feet per minute have been found satisfactory. With High Speed Steel Cutters for the same materials, the following speeds are advocated: For brass, 150 feet to 200 feet per minute; for cast iron, 80 feet to 100 feet per minute; for machinery steel, 80 feet to 100 feet per minute; and for annealed tool steel, 60 feet to 80 feet per minute.

Tables for determining the number of revolutions per minute to obtain the more common surface speeds of cutters of different diameters, will be found on pages 208 and 209.

## Formed Milling Cutters.

**For Milling Sewing Machine and Gun Parts.**

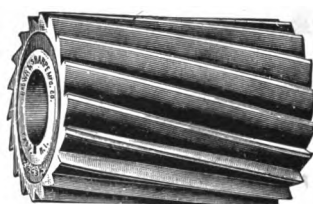


These Cutters can be made in a great variety of outlines and can be sharpened by grinding without changing their form.

They are economical in the production of duplicate and interchangeable parts.

In ordering send sketch or sample of piece to be milled, with size of hole required in cutter.

# Milling Cutters.



Cutters of less than 3-4" face have straight teeth.

Cutters varying from the following list are made to order of any required size.

No.	Diameter.	Width of Face.	Hole.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
M-9	2 1-4"	3-16"	7-8"	\$1 30	\$2 05
M-10	2 1-4	1-2	7-8	1 75	2 85
M-11	2 1-4	1	7-8	2 50	4 55
M-12	2 1-4	1 3-4	7-8	3 30	5 80
M-14	2 1-2	3-16	1	1 30	2 10
M-15	2 1-2	1-4	1	1 40	2 30
M-16	2 1-2	5-16	1	1 50	2 55
M-17	2 1-2	3-8	1	1 60	2 65
M-18	2 1-2	7-16	1	1 70	2 80
M-19	2 1-2	1-2	1	1 80	3 00
M-20	2 1-2	9-16	1	1 90	3 20
M-21	2 1-2	5-8	1	2 00	3 45
M-22	2 1-2	11-16	1	2 10	3 55
M-23	2 1-2	3-4	1	2 20	3 80
M-24	2 1-2	13-16	1	2 30	4 00
M-25	2 1-2	7-8	1	2 40	4 15
M-26	2 1-2	1	1	2 60	4 55
M-27	2 1-2	1 1-8	1	2 75	4 85
M-28	2 1-2	1 1-4	1	2 90	5 15
M-29	2 1-2	1 1-2	1	3 10	5 65
M-30	2 1-2	1 3-4	1	3 40	6 30
M-31	2 1-2	2	1	3 70	6 90
M-32	2 1-2	2 1-4	1	3 90	7 35
M-33	2 1-2	2 1-2	1	4 10	7 85
M-34	2 1-2	2 3-4	1	4 25	8 20
M-35	2 1-2	3	1	4 50	8 80
M-36	2 1-2	3 1-2	1	5 00	9 90
M-37	2 1-2	4	1	5 50	11 00
M-38	2 3-4	3-16	1	1 30	2 20
M-39	2 3-4	1-4	1	1 50	2 50

List continued on next page.

For List of Keyways, see page 242.

# Milling Cutters.

(Continued.)

No.	Diameter.	Width of Face.	Hole.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
M-40	2 3-4"	5-16"	1"	\$1 60	\$2 70
M-41	2 3-4	3-8	1	1 80	2 90
M-42	2 3-4	7-16	1	1 85	3 20
M-43	2 3-4	1-2	1	1 90	3 30
M-44	2 3-4	9-16	1	2 00	3 55
M-45	2 3-4	5-8	1	2 10	3 90
M-45A	2 3-4	11-16	1	2 30	4 05
M-45B	2 3-4	3-4	1	2 50	4 35
M-45C	2 3-4	7-8	1	2 85	4 95
M-46	2 3-4	1	1	3 10	5 35
M-47	2 3-4	1 1-8	1	3 25	5 50
M-48	2 3-4	1 1-4	1	3 40	6 10
M-49	2 3-4	1 1-2	1	3 75	6 80
M-50	2 3-4	1 3-4	1	4 00	7 40
M-51	2 3-4	2	1	4 20	7 95
M-52	2 3-4	2 1-2	1	4 60	9 00
M-53	2 3-4	3	1	5 00	10 00
M-54	2 3-4	3 1-2	1	5 50	11 20
M-55	2 3-4	4	1 1-4	6 00	12 65
M-56	2 3-4	5	1 1-4	7 40	15 30
M-57	2 3-4	6	1 1-4	10 00	19 80
M-61	3	3-16	1	1 35	2 35
M-62	3	1-4	1	1 60	2 75
M-63	3	5-16	1	1 85	3 20
M-63A	3	3-8	1	2 10	3 55
M-64	3	3-8	1 1-4	2 10	3 55
M-65	3	7-16	1 1-4	2 25	3 85
M-66	3	1-2	1 1-4	2 40	4 10
M-67	3	9-16	1 1-4	2 55	4 40
M-68	3	5-8	1 1-4	2 70	4 70
M-69	3	11-16	1 1-4	2 85	4 95
M-70	3	3-4	1 1-4	3 00	5 20
M-71	3	7-8	1 1-4	3 30	5 75
M-72	3	1	1 1-4	3 60	6 35
M-73	3	1 1-4	1 1-4	4 00	7 20
M-74	3	1 1-2	1 1-4	4 30	7 85
M-75	3	1 3-4	1 1-4	4 50	8 45
M-76	3	2	1 1-4	4 70	9 00
M-77	3	2 1-2	1 1-4	5 20	10 35
M-78	3	3	1 1-4	5 40	11 20
M-79	3	3 1-2	1 1-4	5 90	12 50
M-80	3	4	1 1-4	6 40	13 80
M-81	3	5	1 1-4	7 80	16 90

List continued on next page.

For List of Keyways, see page 242

# Milling Cutters.

(Continued.)

No.	Diameter.	Width of Face.	Hole.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
M-82	3"	6"	1 1-4"	\$10 80	\$22 15
M-83	3 1-2	3-16	1	1 45	2 65
M-84	3 1-2	1-4	1	1 70	3 10
M-85	3 1-2	5-16	1	2 05	3 65
M-86	3 1-2	3-8	1	2 40	4 25
M-87	3 1-2	7-16	1	2 75	4 40
M-88	3 1-2	1-2	1 1-4	3 15	5 45
M-89	3 1-2	9-16	1 1-4	3 30	5 75
M-90	3 1-2	5-8	1 1-4	3 45	6 05
M-91	3 1-2	11-16	1 1-4	3 65	6 45
M-92	3 1-2	3-4	1 1-4	3 85	6 80
M-93	3 1-2	7-8	1 1-4	4 35	7 70
M-94	3 1-2	1	1 1-4	4 75	8 25
M-95	3 1-2	1 1-4	1 1-4	5 15	9 10
M-96	3 1-2	1 1-2	1 1-4	5 60	10 00
M-97	3 1-2	1 3-4	1 1-4	6 00	11 30
M-98	3 1-2	2	1 1-4	6 40	12 30
M-99	3 1-2	2 1-2	1 1-4	6 90	13 80
M-99A	3 1-2	2 1-2	1 1-2	6 90	13 80
M-100	3 1-2	3	1 1-4	7 40	15 35
M-100A	3 1-2	3	1 1-2	7 40	15 35
M-101	3 1-2	3 1-2	1 1-4	8 15	16 70
M-101A	3 1-2	3 1-2	1 1-2	8 15	16 70
M-102	3 1-2	4	1 1-4	9 15	19 30
M-102A	3 1-2	4	1 1-2	9 15	19 30
M-103	3 1-2	5	1 1-4	10 40	22 20
M-103A	3 1-2	5	1 1-2	10 40	22 20
M-104	3 1-2	6	1 1-4	11 90	26 30
M-104½	3 1-2	6	1 1-2	11 90	26 30
M-104A	4	1-4	1	2 00	3 80
M-104B	4	5-16	1	2 50	4 55
M-104C	4	3-8	1	3 00	5 35
M-105	4	1-4	1 1-4	2 00	3 80
M-106	4	5-16	1 1-4	2 50	4 55
M-107	4	3-8	1 1-4	3 00	5 35
M-108	4	7-16	1 1-4	3 50	6 15
M-109	4	1-2	1 1-4	3 90	6 85
M-110	4	1-2	1 1-2	3 90	6 85
M-111	4	9-16	1 1-4	4 10	7 25
M-112	4	5-8	1 1-4	4 30	7 65
M-113	4	11-16	1 1-4	4 50	8 05
M-114	4	3-4	1 1-4	4 70	8 45
M-115	4	3-4	1 1-2	4 70	8 45
M-116	4	7-8	1 1-4	5 15	9 30
M-117	4	1	1 1-4	5 65	10 25

List continued on next page.

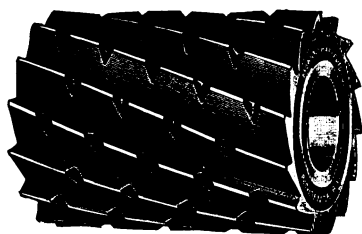
For List of Keyways, see page 242.

# Milling Cutters.

(Continued.)

No.	Diameter.	Width of Face.	Hole.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
M-118	4"	1"	1 1-2"	\$5 65	\$10 25
M-119	4	1 1-4	1 1-4	6 25	11 60
M-120	4	1 1-4	1 1-2	6 25	11 60
M-121	4	1 1-2	1 1-4	6 65	12 70
M-122	4	1 1-2	1 1-2	6 65	12 70
M-123	4	1 3-4	1 1-4	7 05	13 70
M-124	4	1 3-4	1 1-2	7 05	13 70
M-125	4	2	1 1-4	7 45	14 85
M-126	4	2	1 1-2	7 45	14 85
M-127	4	2 1-2	1 1-4	8 40	17 20
M-128	4	3	1 1-4	9 00	19 10
M-128A	4	3	1 1-2	9 00	19 10
M-129	4	3 1-2	1 1-4	10 00	21 55
M-130	4	4	1 1-4	11 00	23 95
M-131	4	4	1 1-2	11 00	23 95
M-132	4	5	1 1-4	13 50	28 95
M-133	4	5	1 1-2	13 50	28 95
M-133A	4	5	1 3-4	13 50	28 95
M-134	4	6	1 1-4	15 50	34 45
M-136	4	6	1 1-2	15 50	34 45
M-137	4 1-2	3-8	1 3-4	3 35	6 20
M-138	4 1-2	3-8	2	3 35	6 20
M-139	4 1-2	7-16	1 3-4	3 75	6 90
M-140	4 1-2	7-16	2	3 75	6 90
M-141	4 1-2	1-2	1 3-4	4 10	7 50
M-142	4 1-2	1-2	2	4 10	7 50
M-143	4 1-2	9-16	1 3-4	4 40	8 15
M-144	4 1-2	9-16	2	4 40	8 15
M-145	4 1-2	5-8	1 3-4	4 60	8 60
M-146	4 1-2	5-8	2	4 60	8 60
M-147	4 1-2	11-16	1 3-4	4 85	9 10
M-148	4 1-2	11-16	2	4 85	9 10
M-149	4 1-2	3-4	1 3-4	5 10	9 60
M-150	4 1-2	3-4	2	5 10	9 60
M-151	4 1-2	7-8	1 3-4	5 50	10 50
M-152	4 1-2	7-8	2	5 50	10 50
M-153	4 1-2	1	1 3-4	6 00	11 55
M-154	4 1-2	1	2	6 00	11 55
M-155	4 1-2	1 1-4	1 3-4	6 60	13 00
M-156	4 1-2	1 1-4	2	6 60	13 00
M-157	4 1-2	1 1-2	1 3-4	7 25	14 60
M-158	4 1-2	1 1-2	2	7 25	14 60
M-159	4 1-2	1 3-4	1 3-4	8 00	16 30
M-160	4 1-2	1 3-4	2	8 00	16 30
M-161	4 1-2	2	1 3-4	8 75	18 00
M-162	4 1-2	2	2	8 75	18 00
M-163	4 1-2	6	2	19 50	45 10

For List of Keyways, see page 242.



## Milling Cutters

### With Nicked Teeth.

Cutters of this form are especially adapted for the heavier class of milling. The teeth being nicked, the chip is broken up, thus enabling a heavier cut to be taken than would be possible with the ordinary milling cutters.

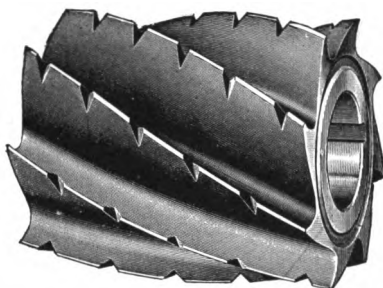
For List of Keyways, see page 242.

No.	Diameter.	Width Face.	Hole.	Carbon Steel each	High Sp. Steel each
M-200	2 1-2"	2 1-2"	1"	\$4 90	\$8 95
M-201	2 1-2	3	1	5 40	10 00
M-202	2 1-2	3 1-2	1	6 00	11 25
M-203	2 1-2	4	1	6 60	12 45
M-204	3	2 1-2	1 1-4	6 25	11 10
M-205	3	3	1 1-4	6 50	12 05
M-206	3	3 1-2	1 1-4	7 10	13 50
M-207	3	4	1 1-4	7 70	14 90
M-208	3	5	1 1-4	9 40	17 80
M-209	3	6	1 1-4	13 00	25 10
M-210	3 1-2	2 1-2	1 1-4	8 25	15 60
M-210A	3 1-2	2 1-2	1 1-2	8 25	15 60
M-211	3 1-2	3	1 1-4	8 90	17 30
M-211A	3 1-2	3	1 1-2	8 90	17 30
M-212	3 1-2	3 1-2	1 1-4	9 80	18 90
M-212A	3 1-2	3 1-2	1 1-2	9 80	18 90
M-213	3 1-2	4	1 1-4	11 00	21 55
M-213A	3 1-2	4	1 1-2	11 00	21 55
M-214	3 1-2	5	1 1-4	12 50	25 00
M-214A	3 1-2	5	1 1-2	12 50	25 00
M-215	3 1-2	6	1 1-4	14 25	29 45
M-215A	3 1-2	6	1 1-2	14 25	29 45
M-216	4	2 1-2	1 1-4	10 00	19 35
M-217	4	2 1-2	1 1-2	10 00	19 35
M-218	4	3	1 1-4	10 80	21 50
M-219	4	3	1 1-2	10 80	21 50
M-220	4	3 1-2	1 1-4	12 00	24 20
M-221	4	3 1-2	1 1-2	12 00	24 20
M-222	4	4	1 1-4	13 20	26 90
M-223	4	4	1 1-2	13 20	26 90
M-224	4	5	1 1-4	16 20	32 55
M-225	4	5	1 1-2	16 20	32 55
M-226	4	6	1 1-4	18 60	38 45
M-227	4	6	1 1-2	18 60	38 45
M-228	4 1-2	2 1-2	1 3-4	11 50	22 90
M-229	4 1-2	2 1-2	2	11 50	22 90
M-230	4 1-2	3	1 3-4	12 75	25 95
M-231	4 1-2	3	2	12 75	25 95
M-232	4 1-2	3 1-2	1 3-4	14 25	29 00
M-233	4 1-2	3 1-2	2	14 25	29 00
M-234	4 1-2	4	1 3-4	15 75	34 45
M-235	4 1-2	4	2	15 75	34 45
M-236	4 1-2	5	1 3-4	18 75	39 45
M-237	4 1-2	5	2	18 75	39 45
M-238	4 1-2	6	1 3-4	22 25	46 85
M-239	4 1-2	6	2	22 25	46 85



# Coarse Tooth Milling Cutters.

**WITH NICKED  
TEETH.**



**HIGH SPEED  
STEEL.**

See page 207 for explanation of advantages of Coarse Tooth Cutters.  
Cutters with less than 1 1-4" face are not made with nicked teeth.

No.	Diameter.	Width of Face.	Hole.	Price.
M-300	2 1-2"	2 1-2"	1"	\$8 95
M-301	2 1-2	3	1	10 00
M-302	2 1-2	4	1	12 45
*M-303	3	1	1 1-4	7 50
*M-304	3	1 1-4	1 1-4	8 40
*M-305	3	1 1-2	1 1-4	9 30
M-306	3	2	1 1-4	10 20
M-307	3	2 1-2	1 1-4	11 10
M-308	3	3	1 1-4	12 05
M-309	3	4	1	14 90
M-310	3	4	1 1-4	14 90
*M-311	3 1-2	1	1 1-2	9 20
*M-312	3 1-2	1 1-4	1 1-2	10 50
*M-313	3 1-2	1 1-2	1 1-2	11 75
*M-314	3 1-2	2	1 1-2	13 90
*M-315	3 1-2	2 1-2	1 1-2	15 60
M-316	3 1-2	3	1 1-2	17 30
M-317	3 1-2	3 1-2	1 1-2	18 90
M-318	3 1-2	4	1 1-2	21 55
M-319	3 1-2	5	1 1-4	25 00
M-320	3 1-2	5	1 1-2	25 00
M-321	3 1-2	6	1 1-2	29 45
M-322	3 3-4	3	1 3-4	18 95
M-323	3 3-4	4	1 3-4	23 70
M-324	3 3-4	5	1 3-4	29 25
M-325	3 3-4	6	1 3-4	34 60
*M-326	4	1	1 1-2	11 40
*M-327	4	1 1-4	1 1-2	12 90
*M-328	4	1 1-2	1 1-2	14 05
*M-329	4	2	1 1-2	16 45
*M-330	4	2 1-2	1 1-2	19 35
M-331	4	3	1 1-2	21 50
M-332	4	3 1-2	1 1-2	24 20

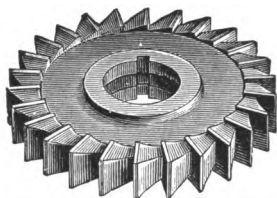
\*Made to order only. List continued on next page. List of Keyways, page 242.

## Coarse Tooth Milling Cutters (Cont.)

No.	Diameter.	Width of Face.	Hole.	Price.
M-333	4"	4"	1 1-2"	\$26 90
M-334	4	5	1 1-2	32 55
M-334A	4	5	1 3-4	32 55
M-335	4	6	1 1-2	38 45
*M-336	4 1-2	1	1 1-2 or 2	13 00
*M-337	4 1-2	1 1-4	1 1-2 or 2	14 45
*M-338	4 1-2	1 1-2	1 1-2 or 2	16 20
*M-339	4 1-2	2	1 1-2 or 2	19 75
*M-340	4 1-2	2 1-2	1 1-2 or 2	22 90
M-341	4 1-2	3	1 1-2 or 2	25 95
M-342	4 1-2	3 1-2	1 1-2 or 2	29 00
M-343	4 1-2	4	1 1-2 or 2	34 45
M-344	4 1-2	5	1 1-2 or 2	39 45
M-345	4 1-2	6	1 1-2 or 2	46 85

\* Made to order only.

For List of Keyways, see page 242.



## Side Milling Cutters.

These cutters are often used in pairs for sizing nuts, bolt heads, etc., and are then called "Straddle Mills." They have teeth upon both sides and edges.

Other sizes made to order.

No.	Diameter.	Width of Face.	Hole.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
S-10	2"	3-16"	1-2"	\$1 85	\$3 05
S-11	2	1-4	1-2	2 00	3 25
S-12	2	3-8	1-2	2 20	3 55
S-13	2	3-16	5-8	1 85	3 05
S-14	2	1-4	5-8	2 00	3 25
S-15	2	3-8	5-8	2 20	3 55
S-16	2 1-2	1-4	7-8	2 20	3 30
S-17	2 1-2	5-16	7-8	2 30	3 60
S-18	2 1-2	3-8	7-8	2 45	3 70
S-19	2 1-2	7-16	7-8	2 55	3 85
S-20	2 1-2	1-2	7-8	2 65	4 10
S-21	2 3-4	1-4	7-8	2 30	3 55
S-22	2 3-4	5-16	7-8	2 50	3 80
S-23	2 3-4	3-8	7-8	2 65	4 00
S-24	2 3-4	7-16	7-8	2 75	4 35
S-24A	2 3-4	7-16	1	2 75	4 35
S-25	2 3-4	1-2	7-8	2 80	4 45
S-25A	2 3-4	1-2	1	2 80	4 45
S-26	3	1-4	1	2 45	3 85
S-27	3	5-16	1	2 75	4 35
S-28	3	3-8	1	3 00	4 75

List continued on next page.

For List of Keyways, see page 242.

## Side Milling Cutters (Cont.)

No.	Diameter.	Width of Face.	Hole.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
S-28A	3"	3-8"	1 1-4"	\$3 00	\$4 75
S-29	3	7-16	1	3 20	5 10
S-30	3	1-2	1	3 35	5 40
S-30A	3	1-2	1 1-4	3 35	5 40
S-31	3 1-2	7-16	1	3 75	5 75
S-32	3 1-2	1-2	1	4 20	6 95
S-32A	3 1-2	1-2	1 1-4	4 20	6 95
S-33	3 1-2	9-16	1	4 55	7 65
S-34	3 1-2	5-8	1	4 55	7 65
S-34A	4	1-4	1	2 90	5 05
S-34B	4	3-8	1	4 05	6 85
S-34C	4	3-8	1 1-4	4 05	6 85
S-35	4	1-2	1	5 10	8 55
S-35A	4	1-2	1 1-4	5 10	8 55
S-36	4	5-8	1	5 55	9 45
S-37	4	5-8	7-8	5 55	9 45
S-38	4	5-8	1 1-4	5 55	9 45
S-39	4	3-4	1	6 00	10 40
S-39A	4	3-4	1 1-4	6 00	10 40
S-40	4	7-8	1	6 50	11 35
S-40A	4	7-8	1 1-4	6 50	11 35
S-40B	5	1-2	1	5 30	9 80
S-40C	5	1-2	1 1-4	5 30	9 80
S-41	5	3-4	1	6 35	12 45
S-42	5	3-4	1 1-4	6 35	12 45
S-42A	5	5-8	1	5 75	11 00
S-42B	5	5-8	1 1-4	5 75	11 00
S-43	5	7-8	1	6 90	13 65
S-43A	5	7-8	1 1-4	6 90	13 65
S-44	5	1	1	7 80	15 05
S-44A	5	1	1 1-4	7 80	15 05
S-44B	6	1-2	1	6 70	12 25
S-44C	6	1-2	1 1-4	6 70	12 25
S-44D	6	5-8	1 1-4	7 15	13 80
S-45	6	3-4	1	7 60	15 35
S-45A	6	3-4	1 1-4	7 60	15 35
S-46	6	15-16	1 1-4	8 65	18 55
S-47	6	15-16	1 1-2	8 65	18 55
S-47A	6	1	1	8 65	18 55
S-47B	6	1	1 1-4	8 65	18 55
S-47C	7	3-4	1 1-4	13 80	23 85
S-48	7	1	1 1-4	16 10	28 95
S-49	7	1 1-8	1 1-4	17 25	31 55
S-50	8	1	1 1-4	19 55	37 30
S-51	8	1 3-8	1 1-4	23 00	46 65
S-52	8	1 3-8	1 1-2	23 00	46 65
S-53	8	1 3-8	1 3-4	23 00	46 65
S-54	8	1 3-8	2	23 00	46 65

For List of Keyways, see page 242.

# Coarse Tooth Side Milling Cutters.

## HIGH SPEED STEEL.

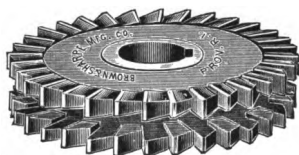


See page 207 for explanation of advantages of Coarse Tooth Cutters.  
Other sizes made to order.

No.	Diameter.	Width of Face.	Hole.	Price.
S-300	2 1-2"	1-4"	1"	\$3 30
S-301	2 1-2	5-16	1	3 60
S-302	2 1-2	3-8	1	3 70
S-303	2 1-2	1-2	1	4 10
S-304	3	1-4	1 1-4	3 85
S-305	3	5-16	1 1-4	4 35
S-306	3	3-8	1 1-4	4 75
S-307	3	7-16	1 1-4	5 10
S-308	3	1-2	1 1-4	5 40
S-309	3 1-2	1-4	1 1-4	4 25
S-310	3 1-2	5-16	1 1-4	4 85
S-311	3 1-2	3-8	1 1-4	5 60
S-312	3 1-2	7-16	1 1-4	5 75
S-313	3 1-2	1-2	1 1-4	6 95
S-314	3 1-2	5-8	1 1-4	7 65
S-315	3 1-2	3-4	1 1-4	8 50
S-316	4	7-16	1 1-2	7 75
S-317	4	1-2	1 1-2	8 55
S-318	4	5-8	1 1-2	9 45
S-319	4	3-4	1 1-2	10 40
S-320	4	7-8	1 1-2	11 35
S-321	4	1	1 1-2	12 45
S-322	5	5-8	1 1-2	11 00
S-323	5	3-4	1 1-2	12 45
S-324	5	7-8	1 1-2	13 65
S-325	5	1	1 1-2	15 05
S-326	6	3-4	1 1-2	15 35
S-327	6	7-8	1 1-2	16 90
S-328	6	1	1 1-2	18 55

For List of Keyways, see page 242.

# Interlocking Side Milling Cutters.



These cutters are made in two parts and can be adjusted easily for maintaining a standard width of slot.

No.	Diameter.	Total Width of Face.	Hole.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
S-200	2"	3-8"	1-2"	\$3 70	\$6 10
S-201	2	1-2	1-2	4 00	6 50
S-202	2	3-4	1-2	4 40	7 10
S-203	2	3-8	5-8	3 70	6 10
S-204	2	1-2	5-8	4 00	6 50
S-205	2	3-4	5-8	4 40	7 10
S-206	2 1-2	1-2	7-8	4 40	6 60
S-207	2 1-2	3-4	7-8	4 90	7 40
S-208	2 1-2	1	7-8	5 30	8 20
S-209	2 3-4	1-2	7-8	4 60	7 10
S-210	2 3-4	3-4	7-8	5 30	8 00
S-211	2 3-4	1	7-8	5 60	8 90
S-212	3	1-2	1	4 90	7 70
S-213	3	3-4	1	6 00	9 50
S-214	3	1	1	6 70	10 80
S-215	3 1-2	1 1-8	1	9 10	15 30
S-216	3 1-2	1 1-4	1	9 10	15 30
S-217	4	1 1-4	1	11 10	18 90
S-218	4	1 1-4	7-8	11 10	18 90
S-219	4	1 1-2	1	12 00	20 80
S-220	5	1 1-2	1	12 70	24 90
S-221	5	1 3-4	1	13 80	27 20
S-222	6	1 7-8	1 1-4	17 30	37 10
S-223	6	1 7-8	1 1-2	17 30	37 10
S-224	7	2 1-4	1 1-4	34 50	63 10
S-225	8	2 3-4	1 1-4	46 00	93 30
S-226	8	2 3-4	1 1-2	46 00	93 30

For List of Keyways, see page 242.

# Milling Cutters and Side Milling Cutters.



Side Milling Cutter.

With  
Inserted  
Teeth.



Milling Cutter.

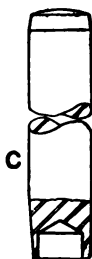
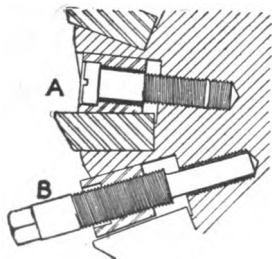
We recommend that Milling Cutters and Side Milling Cutters more than 8" in diameter, be made with inserted teeth. With the exception of the Side Milling Cutters listed below, these cutters are made to order.

The teeth of the cutters are inserted in the periphery of the machinery steel body. They are made of either carbon tool steel, or of high speed steel; but unless otherwise ordered, are furnished of high speed steel. The bushings, screws and teeth are interchangeable, thus allowing the teeth to be easily adjusted or removed.

## Side Milling Cutters.

No.	Diameter.	Width of Face.	Hole.	With Carbon Steel Blades. Price per Cutter.	With High Speed Steel Blades. Price per Cutter.
S-100	6"	2"	1 1-4"	\$15 00	\$15 00
S-101	7	2	1 1-4	17 50	17 50
S-101A	7	2	1 3-4	17 50	17 50
S-102	8	2	1 1-2	20 00	20 00
S-102A	8	2	2	20 00	20 00
S-103	9	2	1 1-2	22 50	22 50
S-104	10	2	1 1-2	25 00	25 00

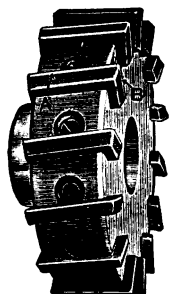
Other sizes made to order. Prices on application. List of Keyways, page 242.



## Removing and Inserting Teeth.

To remove a tooth, take out the screw A and insert extractor B as shown. By turning the extractor with a wrench the bushing is forced out. The tooth can then be removed.

To insert a tooth, place blade in position, drive bushing securely into place using set C. Then insert screw A and tighten firmly. An extractor and set are furnished with each cutter.

**Left Hand Cutter.**

## Face Milling Cutters

### With Inserted Teeth.

The cut shows a form of cutter specially adapted for all classes of face milling.

The body is of machinery steel provided with a taper hole and keyway and is held firmly in place on the arbor by a screw.

Cutters are sent with teeth of high speed steel, unless otherwise ordered. The teeth are held in place by taper bushings and screws and can thus be easily adjusted or removed. The bushings, screws and teeth are interchangeable.

No. of Mill.	Size.	Face A.	Face B.	No. of Taper Hole.	No. of Arbor on which Cutter can be used.	With Carbon Steel Blades. Price per Cutter.	With High Speed Steel Blades. Price per Cutter.
1	5 1-2"	2 1-4"	1 1-16"	10	79 or 80	\$15 00	\$15 00
2	5 1-2	2 1-4	1 1-16	12	81, 82, 84, 85 or 87	15 00	15 00
3	6 1-2	2 1-4	1 1-16	10	79 or 80	17 50	17 50
4	6 1-2	2 1-4	1 1-16	12	81, 82, 83, 84, 85 or 87	17 50	17 50
6	7 1-2	2 1-4	1 1-16	12	81, 82, 83, 84, 85 or 87	20 00	20 00
7	8 1-2	2 1-4	1 3-16	12	81, 82, 83, 84, 85 or 87	22 50	22 50
8	9 1-2	2 1-4	1 3-16	12	81, 82, 83, 84, 85 or 87	25 00	25 00

In ordering, state whether Right or Left Hand cutters are wanted. Other sizes made to order.

In ordering teeth, state whether for Right or Left Hand cutters.

List of Arbors for use with the above cutters shown on page 304.

## Face Milling Cutters

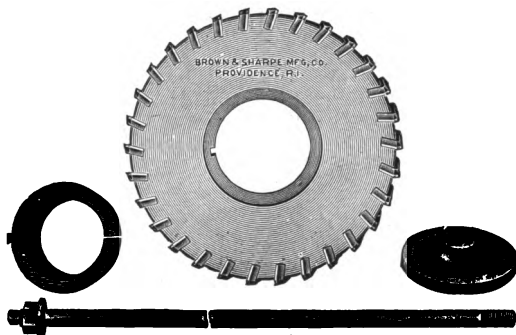
### With Inserted Teeth and Threaded Holes.

These cutters can be used directly upon the spindle of the machine.

No. of Cutter.	Hole.		Cutter.			With Carbon Steel Blades. Price per Cutter.	With High Speed Steel Blades. Price per Cutter.
	Diameter.	Thread.	Diameter.	Face A.	Face B.		
10	2 1-2"	4, L.H.	5 1-2"	2 1-4"	1 1-16"	\$17 50	\$17 50
12	2 1-2	4, L.H.	6 1-2	2 1-4	1 1-16	20 00	20 00
16	2 1-2	4, L.H.	7 1-2	2 1-4	1 1-16	22 50	22 50
15	3 1-4	3 1-2, L.H.	6 1-2	2 1-4	1 1-16	20 00	20 00
18	3 1-4	3 1-2, L.H.	7 1-2	2 1-4	1 1-16	22 50	22 50
21	3 1-4	3 1-2, L.H.	8 1-2	2 1-4	1 3-16	25 00	25 00
24	3 1-4	3 1-2, L.H.	9 1-2	2 1-4	1 3-16	27 50	27 50
19	4	3, L.H.	7 1-2	2 1-4	1 1-16	22 50	22 50
22	4	3, L.H.	8 1-2	2 1-4	1 3-16	25 00	25 00
25	4	3, L.H.	9 1-2	2 1-4	1 3-16	27 50	27 50
22A	4 1-2	2 3-4, L.H.	8 1-2	2 1-4	1 3-16	25 00	25 00
26	4 1-2	2 3-4, L.H.	9 1-2	2 1-4	1 3-16	27 50	27 50

# B & S Inserted Tooth Face Milling Cutters.

Patented July 12, 1910.



This face milling cutter embodies new and important features never before incorporated in the design of cutters of this type. Means are provided for quickly releasing the cutters from the spindle and provision is made whereby the same cutter may be used on machines of different sizes of spindles by employing special sleeves.

The cutter is made with a taper hole to fit a split sleeve of steel that is screwed on to the spindle. It is keyed to the sleeve and is drawn on to the taper of the sleeve by a drawing-in bolt. As the drawing-in bolt is tightened the sleeve is contracted and closely grips the spindle, thus furnishing the full efficiency of the drive to the cutter at all times. It will be noted in the section on next page that the cutter is held close to the spindle shoulder, thus increasing the working space.

The body of the cutter is of machinery steel, while the blades are of high speed steel.

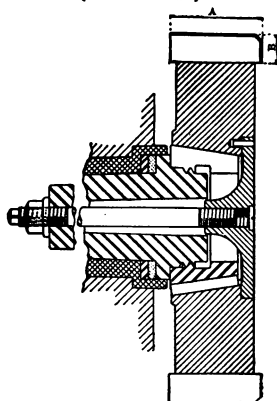
## Cutters.

No. of Cutter.	Dia. of Cutter.	Face A.	Face B.	Sm. Dia. of Taper Hole.	Used with Sleeve No.	Price Cutter only.
50	7"	3"	15-16"	3"	1	\$24 00
51	8	3	15-16	3	1	26 00
52	8	3 1-4	15-16	3 3-4	2 & 5	27 00
53	9	3 1-4	15-16	3 3-4	2 & 5	30 00
54	9	3 1-2	15-16	4 1-2	6 & 8	32 00
55	9	3 3-4	15-16	5	7, 9 & 10	34 00
56	10	3 1-4	15-16	3 3-4	2 & 5	37 00
57	10	3 1-2	15-16	4 1-2	6 & 8	40 00
58	10	3 3-4	15-16	5	7, 9 & 10	43 00
59	12	3 1-2	15-16	4 1-2	6 & 8	48 00
60	12	3 3-4	15-16	5	7, 9 & 10	52 00
61	15	3 3-4	15-16	5	7, 9 & 10	70 00



# B & S Inserted Tooth Face Milling Cutters.

(Continued.)



## Sleeves.

No. of Sleeve.	Outside Diameter of Small End.	Length.	Taper per Foot in Diameter.	Bore.		Price.
				Diameter.	Threads per Inch.	
1	3"	2"	3 1-2"	2 1-2"	4, L.H., U.S.S.	\$6 00
2	3 3-4	2 1-4	3 1-2	2 1-2	4, L.H., U.S.S.	6 50
5	3 3-4	2 1-4	3 1-2	3 1-4	3 1/2, L.H., U.S.S.	7 00
6	4 1-2	2 1-2	3 1-2	3 1-4	3 1/2, L.H., U.S.S.	7 50
7	5	2 3-4	3 1-2	3 1-4	3 1/2, L.H., U.S.S.	8 00
8	4 1-2	2 1-2	3 1-2	4	3, L.H., U.S.S.	8 00
9	5	2 3-4	3 1-2	4	3, L.H., U.S.S.	8 50
10	5	2 3-4	3 1-2	4 1-2	2 3/4, L.H., U.S.S.	9 00

## Clamping Plates.

No. of Plate.	Used With Cutter.	Diameter of Tapped Hole.	Price.
1	50 & 51	5-8"	\$1 00
2	52, 53 & 56	5-8	1 00
3	52, 53 & 56	11-16	1 00
4	54, 57 & 59	11-16	1 00
5	55, 58, 60 & 61	11-16	1 00

The drawing-in bolts for use with the cutters are furnished on short notice. When ordering, the diameter of the spindle hole and the length of the spindle over all must be given.

**Price of Bolts and Nuts, \$1 50.**

# End Mills.



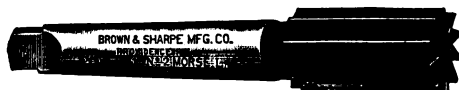
Left Hand Mill.

In ordering, state whether Right or Left Hand Mills are wanted.

No.	Diameter.	No. of Taper.	Length of Cut.	Whole Length.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
E-10	1-4"	4	13-16"	2 7-16"	\$1 00	\$1 40
E-11	1-4	5	13-16	3	1 15	1 70
E-12	5-16	4	7-8	2 1-2	1 00	1 40
E-13	5-16	5	7-8	3 1-16	1 15	1 70
E-14	3-8	4	7-8	2 1-2	1 10	1 55
E-15	3-8	5	7-8	3 1-16	1 20	1 75
E-16	7-16	4	15-16	2 9-16	1 10	1 55
E-17	7-16	5	15-16	3 1-8	1 25	1 80
E-18	1-2	5	1	3 3-16	1 30	1 90
E-19	1-2	7	1 1-8	5 1-8	1 45	2 40
E-20	9-16	5	1 1-16	3 1-4	1 35	2 00
E-21	9-16	7	1 1-4	5 1-4	1 50	2 50
E-22	5-8	5	1 1-4	3 7-16	1 45	2 20
E-23	5-8	7	1 1-2	5 1-2	1 70	2 80
E-24	11-16	7	1 1-2	5 1-2	1 75	2 85
E-25	11-16	9	1 1-2	6 3-4	1 90	3 75
E-26	3-4	7	1 5-8	5 5-8	1 80	2 95
E-27	3-4	9	1 5-8	6 7-8	1 95	3 85
E-28	13-16	7	1 5-8	5 5-8	1 90	3 35
E-29	13-16	9	1 5-8	6 7-8	2 00	4 05
E-30	7-8	7	1 3-4	5 3-4	2 10	3 55
E-31	7-8	9	1 3-4	7	2 25	4 25
E-32	15-16	7	1 3-4	5 3-4	2 10	3 70
E-33	15-16	9	1 3-4	7	2 25	4 25
E-34	1	7	1 7-8	5 7-8	2 15	3 80
E-35	1	9	1 7-8	7 1-8	2 30	4 35
E-36	1 1-16	7	1 7-8	5 7-8	2 15	3 95
E-37	1 1-16	9	1 7-8	7 1-8	2 35	4 40
E-38	1 1-8	7	2	6	2 25	4 20
E-39	1 1-8	9	2	7 1-4	2 40	4 60
E-40	1 3-16	7	2	6	2 25	4 30
E-41	1 3-16	9	2	7 1-4	2 50	4 90
E-42	1 1-4	7	2	6	2 25	4 45
E-43	1 1-4	9	2	7 1-4	2 55	5 10
E-44	1 5-16	9	2 1-8	7 3-8	2 75	5 75
E-45	1 3-8	9	2 1-8	7 3-8	2 75	6 25
E-46	1 7-16	9	2 1-4	7 1-2	3 00	6 50
E-47	1 1-2	9	2 1-4	7 1-2	3 00	6 85
E-48	1 5-8	9	2 3-8	7 5-8	3 25	7 45
E-49	1 3-4	9	2 1-2	7 3-4	3 50	8 30

No. 4 Taper fits A and J Collets; No. 5, C, D, EE, K, N and R Collets; No. 7, BB, DD, **KK**, E, Q, RR and Z Collets; No. 9, F, G, H, O, SS and T Collets. For Collets, see page 297. For List of Tapers, see page 298.

## End Mills—Morse Taper.



In ordering, state whether Right or Left Hand Mills are wanted.

No.	Diameter.	No. of Taper.	Length of Cut.	Whole Length.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
E-300	1-4"	1	13-16"	3 11-16"	\$1 15	\$1 70
E-301	5-16	1	7-8	3 3-4	1 15	1 70
E-302	3-8	1	7-8	3 3-4	1 20	1 75
E-303	7-16	1	15-16	3 13-16	1 25	1 85
E-304	7-16	2	1	4 1-2	1 40	2 25
E-305	1-2	1	1	3 7-8	1 30	1 90
E-306	1-2	2	1 1-8	4 5-8	1 45	2 30
E-307	9-16	1	1 1-16	3 15-16	1 35	2 00
E-308	9-16	2	1 1-4	4 3-4	1 50	2 40
E-309	5-8	2	1 1-2	5	1 55	2 50
E-310	11-16	2	1 1-2	5	1 75	2 75
E-311	3-4	2	1 5-8	5 1-8	1 80	2 85
E-312	3-4	3	1 5-8	6	1 95	3 45
E-313	13-16	2	1 5-8	5 1-8	1 90	3 05
E-314	13-16	3	1 5-8	6	2 00	3 50
E-315	7-8	2	1 3-4	5 1-4	2 10	3 40
E-316	7-8	3	1 3-4	6 1-8	2 25	3 75
E-317	15-16	2	1 3-4	5 1-4	2 10	3 45
E-318	15-16	3	1 3-4	6 1-8	2 25	3 85
E-319	1	2	1 7-8	5 3-8	2 15	3 60
E-320	1	3	1 7-8	6 1-4	2 30	4 00
E-321	1 1-16	2	1 7-8	5 3-8	2 15	3 75
E-322	1 1-16	3	1 7-8	6 1-4	2 30	4 05
E-323	1 1-8	3	2	6 3-8	2 35	4 25
E-324	1 3-16	3	2	6 3-8	2 40	4 45
E-325	1 1-4	3	2	6 3-8	2 45	4 65
E-326	1 1-4	4	2	7 3-8	2 55	5 00
E-327	1 5-16	3	2 1-8	6 1-2	2 65	5 10
E-328	1 5-16	4	2 1-8	7 1-2	2 75	5 40
E-329	1 3-8	3	2 1-8	6 1-2	2 65	5 20
E-330	1 3-8	4	2 1-8	7 1-2	2 75	5 60
E-331	1 7-16	3	2 1-4	6 5-8	2 75	5 50
E-332	1 7-16	4	2 1-4	7 5-8	3 00	6 10
E-333	1 1-2	3	2 1-4	6 5-8	2 75	5 65
E-334	1 1-2	4	2 1-4	7 5-8	3 00	6 25
E-335	1 5-8	4	2 3-8	7 3-4	3 25	7 05
E-336	1 3-4	4	2 3-8	7 3-4	3 50	7 80
E-337	1 7-8	4	2 1-2	7 7-8	3 75	8 55
E-338	2	4	2 1-2	7 7-8	4 00	9 85

# Spiral End Mills.



**Left Hand Mill.**

**In ordering, state whether Right or Left Hand Mills are wanted.**

No.	Diameter.	No. of Taper.	Length of Cut.	Whole Length.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
E-100	1-4"	4	13-16"	2 7-16"	\$1 00	\$1 40
E-101	1-4	5	13-16	3	1 15	1 70
E-102	5-16	4	7-8	2 1-2	1 00	1 40
E-103	5-16	5	7-8	3 1-16	1 15	1 70
E-104	3-8	4	7-8	2 1-2	1 10	1 55
E-105	3-8	5	7-8	3 1-16	1 20	1 75
E-106	7-16	4	15-16	2 9-16	1 10	1 55
E-107	7-16	5	15-16	3 1-8	1 25	1 80
E-108	1-2	5	1	3 3-16	1 30	1 90
E-109	1-2	7	1 1-8	5 1-8	1 45	2 40
E-110	9-16	5	1 1-16	3 1-4	1 35	2 00
E-111	9-16	7	1 1-4	5 1-4	1 50	2 50
E-112	5-8	5	1 1-4	3 7-16	1 45	2 20
E-113	5-8	7	1 1-2	5 1-2	1 70	2 80
E-114	11-16	7	1 1-2	5 1-2	1 75	2 85
E-115	11-16	9	1 1-2	6 3-4	1 90	3 75
E-116	3-4	7	1 5-8	5 5-8	1 80	2 95
E-117	3-4	9	1 5-8	6 7-8	1 95	3 85
E-118	13-16	7	1 5-8	5 5-8	1 90	3 35
E-119	13-16	9	1 5-8	6 7-8	2 00	4 05
E-120	7-8	7	1 3-4	5 3-4	2 10	3 55
E-121	7-8	9	1 3-4	7	2 25	4 25
E-122	15-16	7	1 3-4	5 3-4	2 10	3 70
E-123	15-16	9	1 3-4	7	2 25	4 25
E-124	1	7	1 7-8	5 7-8	2 15	3 80
E-125	1	9	1 7-8	7 1-8	2 30	4 35
E-126	1 1-16	7	1 7-8	5 7-8	2 15	3 95
E-127	1 1-16	9	1 7-8	7 1-8	2 35	4 40
E-128	1 1-8	7	2	6	2 25	4 20
E-129	1 1-8	9	2	7 1-4	2 40	4 60
E-130	1 3-16	7	2	6	2 25	4 30
E-131	1 3-16	9	2	7 1-4	2 50	4 90
E-132	1 1-4	7	2	6	2 25	4 45
E-133	1 1-4	9	2	7 1-4	2 55	5 10
E-134	1 5-16	9	2 1-8	7 3-8	2 75	5 75
E-135	1 3-8	9	2 1-8	7 3-8	2 75	6 25
E-136	1 7-16	9	2 1-4	7 1-2	3 00	6 50
E-137	1 1-2	9	2 1-4	7 1-2	3 00	6 85
E-138	1 5-8	9	2 3-8	7 5-8	3 25	7 45
E-139	1 3-4	9	2 1-2	7 3-4	3 50	8 30

No. 4 Taper fits A and J Collets; No. 5, C, D, EE, K, N and R Collets; No. 7, BB, DD, KK, E, Q, RR and Z Collets; No. 9, F, G, H, O, SS and T Collets. For Collets, see page 297. For List of Tapers, see page 298.

# Spiral End Mills.

## Morse Taper.



In ordering, state whether Right or Left Hand Mills are wanted.

No.	Diameter.	No. of Taper.	Length of Cut.	Whole Length.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
E-395	1-4"	1	13-16"	3 11-16"	\$1 15	\$1 70
E-396	5-16	1	7-8	3 3-4	1 15	1 70
E-397	3-8	1	7-8	3 3-4	1 20	1 75
E-398	7-16	1	15-16	3 13-16	1 25	1 85
E-399	7-16	2	1	4 1-2	1 40	2 25
E-400	1-2	1	1	3 7-8	1 30	1 90
E-401	1-2	2	1 1-8	4 5-8	1 45	2 30
E-402	9-16	1	1 1-16	3 15-16	1 35	2 00
E-403	9-16	2	1 1-4	4 3-4	1 50	2 40
E-404	5-8	2	1 1-2	5	1 55	2 50
E-405	11-16	2	1 1-2	5	1 75	2 75
E-406	3-4	2	1 5-8	5 1-8	1 80	2 85
E-407	3-4	3	1 5-8	6	1 95	3 45
E-408	13-16	2	1 5-8	5 1-8	1 90	3 05
E-409	13-16	3	1 5-8	6	2 00	3 50
E-410	7-8	2	1 3-4	5 1-4	2 10	3 40
E-411	7-8	3	1 3-4	6 1-8	2 25	3 75
E-412	15-16	2	1 3-4	5 1-4	2 10	3 45
E-413	15-16	3	1 3-4	6 1-8	2 25	3 85
E-414	1	2	1 7-8	5 3-8	2 15	3 60
E-415	1	3	1 7-8	6 1-4	2 30	4 00
E-416	1 1-16	2	1 7-8	5 3-8	2 15	3 75
E-417	1 1-16	3	1 7-8	6 1-4	2 30	4 05
E-418	1 1-8	3	2	6 3-8	2 35	4 25
E-419	1 3-16	3	2	6 3-8	2 40	4 45
E-420	1 1-4	3	2	6 3-8	2 45	4 65
E-421	1 1-4	4	2	7 3-8	2 55	5 00
E-422	1 5-16	3	2 1-8	6 1-2	2 65	5 10
E-423	1 5-16	4	2 1-8	7 1-2	2 75	5 40
E-424	1 3-8	3	2 1-8	6 1-2	2 65	5 20
E-425	1 3-8	4	2 1-8	7 1-2	2 75	5 60
E-426	1 7-16	3	2 1-4	6 5-8	2 75	5 50
E-427	1 7-16	4	2 1-4	7 5-8	3 00	6 10
E-428	1 1-2	3	2 1-4	6 5-8	2 75	5 65
E-429	1 1-2	4	2 1-4	7 5-8	3 00	6 25
E-430	1 5-8	4	2 3-8	7 3-4	3 25	7 05
E-431	1 3-4	4	2 3-8	7 3-4	3 50	7 80
E-432	1 7-8	4	2 1-2	7 7-8	3 75	8 55
E-433	2	4	2 1-2	7 7-8	4 00	9 35

## End Mills with Centre Cut.



**Left Hand Mill.**

**In ordering, state whether Right or Left Hand Mills are wanted.**

These end mills are useful where it is desired to cut into the work with the end of the mill and then move along as in cams, grooves, etc., as the teeth are sharp on the inside, and thus cut a path out from the first entering point. They are also useful in taking heavy cuts, especially in cast iron.

No.	Diameter.	No. of Taper.	Length of Cut.	Whole Length.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
E-200	1-2"	5	1"	3 3-16"	\$1 30	\$1 90
E-201	1-2	7	1 1-8	5 1-8	1 45	2 40
E-202	9-16	5	1 1-16	3 1-4	1 35	2 00
E-203	9-16	7	1 1-4	5 1-4	1 50	2 50
E-204	5-8	5	1 1-4	3 7-16	1 45	2 20
E-205	5-8	7	1 1-2	5 1-2	1 70	2 80
E-206	11-16	7	1 1-2	5 1-2	1 75	2 85
E-207	11-16	9	1 1-2	6 3-4	1 90	3 75
E-208	3-4	7	1 5-8	5 5-8	1 80	2 95
E-209	3-4	9	1 5-8	6 7-8	1 95	3 85
E-210	13-16	7	1 5-8	5 5-8	1 90	3 35
E-211	13-16	9	1 5-8	6 7-8	2 00	4 05
E-212	7-8	7	1 3-4	5 3-4	2 10	3 55
E-213	7-8	9	1 3-4	7	2 25	4 25
E-214	15-16	7	1 3-4	5 3-4	2 10	3 70
E-215	15-16	9	1 3-4	7	2 25	4 25
E-216	1	7	1 7-8	5 7-8	2 15	3 80
E-217	1	9	1 7-8	7 1-8	2 30	4 35
E-218	1 1-16	7	1 7-8	5 7-8	2 15	3 95
E-219	1 1-16	9	1 7-8	7 1-8	2 35	4 40
E-220	1 1-8	7	2	6	2 25	4 20
E-221	1 1-8	9	2	7 1-4	2 40	4 60
E-222	1 3-16	7	2	6	2 25	4 30
E-223	1 3-16	9	2	7 1-4	2 50	4 90
E-224	1 1-4	7	2	6	2 25	4 45
E-225	1 1-4	9	2	7 1-4	2 55	5 10
E-226	1 5-16	9	2 1-8	7 3-8	2 75	5 75
E-227	1 3-8	9	2 1-8	7 3-8	2 75	6 25
E-228	1 7-16	9	2 1-4	7 1-2	3 00	6 50
E-229	1 1-2	9	2 1-4	7 1-2	3 00	6 85

No. 5, C, D, EE, K, N and R Collets; No. 7, BB, DD, KK, E, Q, RR and Z Collets; No. 9, F, G, H, O, SS and T Collets. Collets, page 297. List of Tapers, page 298.

# End Mills with Centre Cut.

## Morse Taper.



Left Hand Mill.

In ordering, state whether Right or Left Hand Mills are wanted.

These end mills are useful where it is desired to cut into the work with the end of the mill and then move along as in cams, grooves, etc., as the teeth are sharp on the inside, and thus cut a path out from the first entering point. They are also useful in taking heavy cuts, especially in cast iron.

No.	Diameter.	No. of Taper.	Length of Cut.	Whole Length.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
E-500	1-2"	1	1"	3 7-8"	\$1 30	\$1 90
E-501	1-2	2	1 1-8	4 5-8	1 45	2 30
E-502	9-16	1	1 1-16	3 15-16	1 35	2 00
E-503	9-16	2	1 1-4	4 3-4	1 50	2 40
E-504	5-8	2	1 1-2	5	1 55	2 50
E-505	11-16	2	1 1-2	5	1 75	2 75
E-506	3-4	2	1 5-8	5 1-8	1 80	2 85
E-507	3-4	3	1 5-8	6	1 95	3 45
E-508	13-16	2	1 5-8	5 1-8	1 90	3 05
E-509	13-16	3	1 5-8	6	2 00	3 50
E-510	7-8	2	1 3-4	5 1-4	2 10	3 40
E-511	7-8	3	1 3-4	6 1-8	2 25	3 85
E-512	15-16	2	1 3-4	5 1-4	2 10	3 45
E-513	15-16	3	1 3-4	6 1-8	2 25	3 85
E-514	1	2	1 7-8	5 3-8	2 15	3 40
E-515	1	3	1 7-8	6 1-4	2 30	4 00
E-516	1 1-16	2	1 7-8	5 3-8	2 15	3 75
E-517	1 1-16	3	1 7-8	6 1-4	2 30	4 05
E-518	1 1-8	3	2	6 3-8	2 35	4 25
E-519	1 3-16	3	2	6 3-8	2 40	4 45
E-520	1 1-4	3	2	6 3-8	2 45	4 65
E-521	1 1-4	4	2	7 3-8	2 55	5 00
E-522	1 5-16	3	2 1-8	6 1-2	2 65	5 10
E-523	1 5-16	4	2 1-8	7 1-2	2 75	5 40
E-524	1 3-8	3	2 1-8	6 1-2	2 65	5 20
E-525	1 3-8	4	2 1-8	7 1-2	2 75	5 60
E-526	1 7-16	3	2 1-4	6 5-8	2 75	5 50
E-527	1 7-16	4	2 1-4	7 5-8	3 00	6 10
E-528	1 1-2	3	2 1-4	6 5-8	2 75	5 65
E-529	1 1-2	4	2 1-4	7 5-8	3 00	6 25

## Coarse Tooth Spiral End Mills. High Speed Steel.



See page 207 for explanation of advantages of Coarse Tooth Cutters.  
In ordering, state whether Right or Left Hand Mills are wanted.

No.	Diameter.	No. of Taper.	Length of Cut.	Whole Length.	High Speed Steel Cutters. Price each.
E-700	1-4"	4	13-16"	2 7-16"	\$1 40
E-701	1-4	5	13-16	3	1 70
E-702	5-16	4	7-8	2 1-2	1 40
E-703	5-16	5	7-8	3 1-16	1 70
E-704	3-8	4	7-8	2 1-2	1 55
E-705	3-8	5	7-8	3 1-16	1 75
E-706	7-16	4	15-16	2 9-16	1 55
E-707	7-16	5	15-16	3 1-8	1 80
E-708	1-2	5	1	3 3-16	1 90
E-709	1-2	7	1 1-8	5 1-8	2 40
E-710	9-16	5	1 1-16	3 1-4	2 00
E-711	9-16	7	1 1-4	5 1-4	2 50
E-712	5-8	5	1 1-4	3 7-16	2 20
E-713	5-8	7	1 1-2	5 1-2	2 80
E-714	11-16	7	1 1-2	5 1-2	2 85
E-715	11-16	9	1 1-2	6 3-4	3 75
E-716	3-4	7	1 5-8	5 5-8	2 95
E-717	3-4	9	1 5-8	6 7-8	3 85
E-718	13-16	7	1 5-8	5 5-8	3 35
E-719	13-16	9	1 5-8	6 7-8	4 05
E-720	7-8	7	1 3-4	5 3-4	3 55
E-721	7-8	9	1 3-4	7	4 25
E-722	15-16	7	1 3-4	5 3-4	3 70
E-723	15-16	9	1 3-4	7	4 25
E-724	1	7	1 7-8	5 7-8	3 80
E-725	1	9	1 7-8	7 1-8	4 35
E-726	1 1-16	7	1 7-8	5 7-8	3 95
E-727	1 1-16	9	1 7-8	7 1-8	4 40
E-728	1 1-8	7	2	6	4 20
E-729	1 1-8	9	2	7 1-4	4 60
E-730	1 3-16	7	2	6	4 30
E-731	1 3-16	9	2	7 1-4	4 90
E-732	1 1-4	7	2	6	4 45
E-733	1 1-4	9	2	7 1-4	5 10
E-734	1 5-16	9	2 1-8	7 3-8	5 75
E-735	1 3-8	9	2 1-8	7 3-8	6 25
E-736	1 7-16	9	2 1-4	7 1-2	6 50
E-737	1 1-2	9	2 1-4	7 1-2	6 85
E-738	1 5-8	9	2 3-8	7 5-8	7 45
E-739	1 3-4	9	2 1-2	7 3-4	8 30

No. 4 Taper fits A & J Collets; No. 5, C, D, EE, K, N & R Collets; No. 7, BB, DD, KK, E, Q, RR & Z Collets; No. 9, F, G, H, O, SS & T Collets. Collets, page 297. List of Tapers, page 298.



# Coarse Tooth Spiral End Mills.

## High Speed Steel—Morse Taper.



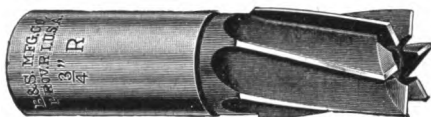
See page 207 for explanation of advantages of Coarse Tooth Cutters.

**In ordering, state whether Right or Left Hand Mills are wanted.**

No.	Diameter.	No. of Taper.	Length of Cut.	Whole Length.	High Speed Steel Cutters. Price each.
E-750	1-4"	1	13-16"	3 11-16"	\$1 70
E-751	5-16	1	7-8	3 3-4	1 70
E-752	3-8	1	7-8	3 3-4	1 75
E-753	7-16	1	15-16	3 13-16	1 85
E-754	7-16	2	1	4 1-2	2 25
E-755	1-2	1	1	3 7-8	1 90
E-756	1-2	2	1 1-8	4 5-8	2 30
E-757	9-16	1	1 1-16	3 15-16	2 00
E-758	9-16	2	1 1-4	4 3-4	2 40
E-759	5-8	2	1 1-2	5	2 50
E-760	11-16	2	1 1-2	5	2 75
E-761	3-4	2	1 5-8	5 1-8	2 85
E-762	3-4	3	1 5-8	6	3 45
E-763	13-16	2	1 5-8	5 1-8	3 05
E-764	13-16	3	1 5-8	6	3 50
E-765	7-8	2	1 3-4	5 1-4	3 40
E-766	7-8	3	1 3-4	6 1-8	3 75
E-767	15-16	2	1 3-4	5 1-4	3 45
E-768	15-16	3	1 3-4	6 1-8	3 85
E-769	1	2	1 7-8	5 3-8	3 60
E-770	1	3	1 7-8	6 1-4	4 00
E-771	1 1-16	2	1 7-8	5 3-8	3 75
E-772	1 1-16	3	1 7-8	6 1-4	4 05
E-773	1 1-8	3	2	6 3-8	4 25
E-774	1 3-16	3	2	6 3-8	4 45
E-775	1 1-4	3	2	6 3-8	4 65
E-776	1 1-4	4	2	7 3-8	5 00
E-777	1 5-16	3	2 1-8	6 1-2	5 10
E-778	1 5-16	4	2 1-8	7 1-2	5 40
E-779	1 3-8	3	2 1-8	6 1-2	5 20
E-780	1 3-8	4	2 1-8	7 1-2	5 60
E-781	1 7-16	3	2 1-4	6 5-8	5 50
E-782	1 7-16	4	2 1-4	7 5-8	6 10
E-783	1 1-2	3	2 1-4	6 5-8	5 65
E-784	1 1-2	4	2 1-4	7 5-8	6 25
E-785	1 5-8	4	2 3-8	7 3-4	7 05
E-786	1 3-4	4	2 3-8	7 3-4	7 80
E-787	1 7-8	4	2 1-2	7 7-8	8 55
E-788	2	4	2 1-2	7 7-8	9 35

# Straight Shank End Mills.

To be Used with Spring Collets.



In ordering, state whether Right or Left Hand Mills are wanted.

No.	Diameter	Length of Cut	Whole Length.	Carbon Steel Cutters. Price each.	High Speed Cutters. Price each.
E-650	1-8"	5-16"	1 1-4"	\$0 35	\$0 50
E-651	5-32	5-16	1 1-4	40	60
E-652	3-16	9-16	1 1-2	45	70
E-653	7-32	9-16	1 1-2	50	80
E-654	1-4	3-4	1 7-8	55	90
E-655	9-32	3-4	1 7-8	60	1 00
E-656	5-16	13-16	1 15-16	70	1 10
E-657	11-32	13-16	1 15-16	75	1 20
E-658	3-8	13-16	2	80	1 30
E-659	13-32	13-16	2	85	1 40
E-660	7-16	7-8	2 1-8	1 00	1 50
E-661	1-2	15-16	2 1-4	1 25	1 70
E-662	9-16	15-16	2 5-16	1 35	1 90
E-663	5-8	1	2 3-8	1 50	2 10
E-664	11-16	1	2 3-8	1 60	2 30
E-665	3-4	1 1-8	2 15-16	1 70	2 50
E-666	13-16	1 1-8	2 15-16	1 80	2 75
E-667	7-8	1 5-16	3 3-16	1 90	3 00
E-668	15-16	1 5-16	3 3-16	2 00	3 25
E-669	1	1 3-8	3 7-16	2 05	3 50

Diameter of shank is same as diameter of cut.

All Mills less than 3-8" diameter have straight teeth.

# Slotting End Mills—"Two Lipped."

## High Speed Steel.



In ordering, state whether Right or Left Hand Mills are wanted.

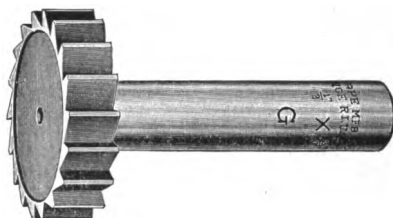
These End Mills are new in design and are found especially adaptable to rapidly milling slots in steel and iron from the solid, where previously it was necessary to drill a series of holes and make several cuts in milling the slot. The best results are obtained by maintaining a high surface speed.

A depth of cut equal to one-half the diameter of the mill, can usually be taken from solid stock.

No.	Diameter.	No. of Taper Shank.	Length of Cut.	Whole Length.	Price.
E-597	1-4"	4	3-8"	2"	\$1 40
E-598	1-4	5	3-8	2 1-2	1 70
E-599	5-16	5	15-32	2 19-32	1 70
E-600	1-4	7	3-8	4 3-8	2 00
E-601	5-16	7	15-32	4 15-32	2 10
E-602	3-8	7	9-16	4 9-16	2 15
E-603	7-16	7	21-32	4 21-32	2 25
E-604	1-2	7	3-4	4 3-4	2 40
E-605	9-16	7	27-32	4 27-32	2 50
E-606	5-8	7	15-16	4 15-16	2 80
E-607	11-16	7	1 1-32	5 1-32	2 85
E-608	3-4	7	1 1-8	5 1-8	2 95
E-609	3-4	9	1 1-8	6 3-8	3 85
E-610	13-16	7	1 7-32	5 7-32	3 35
E-611	13-16	9	1 7-32	6 15-32	4 05
E-612	7-8	7	1 5-16	5 5-16	3 55
E-613	7-8	9	1 5-16	6 9-16	4 25
E-614	15-16	9	1 13-32	6 21-32	4 25
E-615	1	9	1 1-2	6 3-4	4 35
E-616	1 1-16	9	1 19-32	6 27-32	4 40
E-617	1 1-8	9	1 11-16	6 15-16	4 60
E-618	1 3-16	9	1 25-32	7 1-32	4 90
E-619	1 1-4	9	1 7-8	7 1-8	5 10
E-620	1 5-16	9	1 31-32	7 7-32	5 75
E-621	1 3-8	9	2 1-16	7 5-16	6 25
E-622	1 7-16	9	2 5-32	7 13-32	6 50
E-623	1 1-2	9	2 1-4	7 1-2	6 85

No. 4 Taper fits A and J Collets; No. 5, C, D and K Collets; No. 7, KK and E Collets; No. 9, F, G, H, O, SS and T Collets. For Collets, see page 297. For List of Tapers, see page 298.

# Woodruff Keyseat Cutters.



**Right Hand Cutters are furnished unless otherwise ordered.**

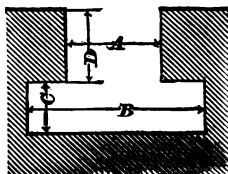
No.	Diameter.	Thick.	Shank.	Carbon Steel. Price each.	High Speed Steel. Price each.
*1	1-2"	1-16"	1-2"	\$0 95	
*2	1-2	3-32	1-2	95	
3	1-2	1-8	1-2	95	\$1 20
4	5-8	3-32	1-2	1 10	1 40
5	5-8	1-8	1-2	1 10	1 40
6	5-8	5-32	1-2	1 10	1 40
7	3-4	1-8	1-2	1 20	1 60
8	3-4	5-32	1-2	1 20	1 60
9	3-4	3-16	1-2	1 20	1 60
10	7-8	5-32	1-2	1 40	1 95
11	7-8	3-16	1-2	1 40	1 95
12	7-8	7-32	1-2	1 40	1 95
A	7-8	1-4	1-2	1 40	1 95
13	1	3-16	1-2	1 55	2 35
14	1	7-32	1-2	1 55	2 35
15	1	1-4	1-2	1 55	2 35
B	1	5-16	1-2	1 55	2 35
16	1 1-8	3-16	1-2	1 75	2 75
17	1 1-8	7-32	1-2	1 75	2 75
18	1 1-8	1-4	1-2	1 75	2 75
C	1 1-8	5-16	1-2	1 75	2 75
19	1 1-4	3-16	1-2	1 90	3 20
20	1 1-4	7-32	1-2	1 90	3 20
21	1 1-4	1-4	1-2	1 90	3 20
D	1 1-4	5-16	1-2	1 90	3 20
E	1 1-4	3-8	1-2	1 90	3 20
22	1 3-8	1-4	1-2	2 15	3 80
23	1 3-8	5-16	1-2	2 15	3 80
F	1 3-8	3-8	1-2	2 15	3 80
24	1 1-2	1-4	1-2	2 15	3 95
25	1 1-2	5-16	1-2	2 15	3 95
G	1 1-2	3-8	1-2	2 15	3 95

\*1 and 2 not made from High Speed Steel.

## Standard T Slot Cutters.



Left Hand Cutter.



In ordering, state whether Right or Left Hand Cutters are wanted.

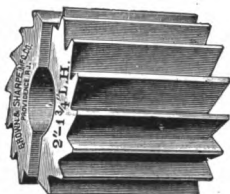
No. of Cutter.	Width of Slot A.	Diameter of Neck of Cutter.	Width of Slot B.	Depth C.	Extreme Limit D.	No. of Taper.	Carbon Steel Cutters Price each.	High Speed Steel Cutters Price each.
4	1-4"	7-32"	1-2"	5-32"	5-16"	4	\$1 50	\$2 10
7	1-4	7-32	1-2	5-32	5-16	5	1 60	2 25
10	5-16	9-32	5-8	5-32	3-8	5	1 80	2 60
13	5-16	9-32	5-8	5-32	3-8	7	2 10	3 25
16	3-8	11-32	11-16	7-32	7-16	5	2 00	2 90
19	3-8	11-32	11-16	7-32	7-16	7	2 20	3 35
22	7-16	3-8	13-16	7-32	7-16	7	2 35	3 65
25	7-16	3-8	13-16	7-32	7-16	9	2 50	4 25
28	1-2	7-16	15-16	9-32	9-16	7	2 60	4 15
31	1-2	7-16	15-16	9-32	9-16	9	2 80	4 80
34	5-8	17-32	1 3-16	13-32	3-4	9	3 10	5 55
37	3-4	21-32	1 5-16	17-32	1	9	3 45	6 35
40	7-8	25-32	1 5-8	11-16	1 1-16	9	3 75	7 75
43	1	29-32	1 7-8	13-16	1 3-16	9	4 00	8 95

These cutters are made 1-32" larger in diameter and 1-64" greater in thickness than the figures given, to allow for sharpening.

Other sizes made to order.

Collets, page 297. List of Tapers, page 298.

## Shell End Mills.



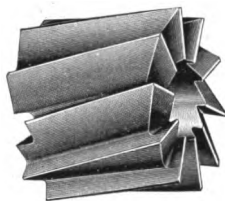
**Left Hand Mill.**

No.	Diameter.	Length of Cut.	No. of Arbor on which Cutter can be used.	Hole.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
F-10	1 1-4"	1 1-4"	89	1-2"	\$2 80	\$4 50
F-11	1 5-16	1 1-4		1-2	2 90	4 65
F-12	1 3-8	1 1-4		1-2	3 00	4 80
F-13	1 7-16	1 1-4		1-2	3 10	4 95
F-14	1 1-2	1 1-4	93	1-2	3 20	5 10
F-15	1 9-16	1 3-4		3-4	3 90	5 50
F-16	1 5-8	1 3-4	90	3-4	3 95	5 70
F-17	1 11-16	1 3-4		3-4	4 00	5 90
F-18	1 3-4	1 3-4	94	3-4	4 05	6 10
F-19	1 13-16	1 3-4		3-4	4 10	6 30
F-20	1 7-8	1 3-4	97	3-4	4 15	6 50
F-21	1 15-16	1 3-4		3-4	4 20	6 70
F-22	2	1 3-4	101	3-4	4 30	6 90
F-23	2 1-16	1 3-4		3-4	4 35	7 10
F-24	2 1-8	1 3-4	103	3-4	4 40	7 30
F-25	2 3-16	1 3-4		3-4	4 50	7 50
F-26	2 1-4	2 1-4	91	1	4 90	8 00
F-27	2 5-16	2 1-4		1	4 95	8 25
F-28	2 3-8	2 1-4		1	5 00	8 55
F-29	2 7-16	2 1-4		1	5 05	8 85
F-30	2 1-2	2 1-4	95	1	5 10	9 15
F-31	2 9-16	2 1-4		1	5 20	9 45
F-32	2 5-8	2 1-4	100	1	5 35	9 75
F-33	2 11-16	2 1-4		1	5 50	10 05
F-34	2 3-4	2 1-4	102	1	5 65	10 40
F-35	2 13-16	2 1-4		1	5 80	10 70
F-36	2 7-8	2 1-4	105	1	5 95	11 05
F-37	2 15-16	2 1-4		1	6 10	11 40
F-38	3	2 1-4		1	6 30	11 75

In ordering, state whether Right or Left Hand Mills are wanted.

List of Arbors for use with the above End Mills, page 303.

# Spiral Shell End Mills.



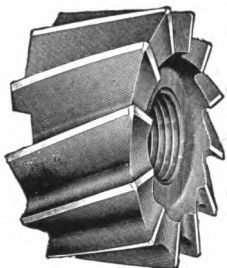
**Left Hand Mill.**

No.	Diameter.	Length of Cut.	No. of Arbor on which Cutter can be used.	Hole.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
F-100	1 1-4"	1 1-4"	89	1-2"	\$2 80	\$4 50
F-101	1 5-16	1 1-4		1-2	2 90	4 65
F-102	1 3-8	1 1-4	92	1-2	3 00	4 80
F-103	1 7-16	1 1-4		1-2	3 10	4 95
F-104	1 1-2	1 1-4	93	1-2	3 20	5 10
F-105	1 9-16	1 3-4		3-4	3 90	5 50
F-106	1 5-8	1 3-4	94	3-4	3 95	5 70
F-107	1 11-16	1 3-4		3-4	4 00	5 90
F-108	1 3-4	1 3-4	96	3-4	4 05	6 10
F-109	1 13-16	1 3-4		3-4	4 10	6 30
F-110	1 7-8	1 3-4	97	3-4	4 15	6 50
F-111	1 15-16	1 3-4		3-4	4 20	6 70
F-112	2	1 3-4	101	3-4	4 30	6 90
F-113	2 1-16	1 3-4		3-4	4 35	7 10
F-114	2 1-8	1 3-4	103	3-4	4 40	7 30
F-115	2 3-16	1 3-4		3-4	4 50	7 50
F-116	2 1-4	2 1-4	91	1	4 90	8 00
F-117	2 5-16	2 1-4		1	4 95	8 25
F-118	2 3-8	2 1-4	95	1	5 00	8 55
F-119	2 7-16	2 1-4		1	5 05	8 85
F-120	2 1-2	2 1-4	98	1	5 10	9 15
F-121	2 9-16	2 1-4		1	5 20	9 45
F-122	2 5-8	2 1-4	100	1	5 35	9 75
F-123	2 11-16	2 1-4		1	5 50	10 05
F-124	2 3-4	2 1-4	102	1	5 65	10 40
F-125	2 13-16	2 1-4		1	5 80	10 70
F-126	2 7-8	2 1-4	104	1	5 95	11 05
F-127	2 15-16	2 1-4		1	6 10	11 40
F-128	3	2 1-4	105	1	6 30	11 75

In ordering, state whether Right or Left Hand Mills are wanted.

List of Arbors for use with the above End Mills, page 303.

## Coarse Tooth Spiral Shell End Mills.



### High Speed Steel.

In ordering state whether Right or Left Hand Mills are wanted.

See page 207 for explanation of advantages of Coarse Tooth Cutters.

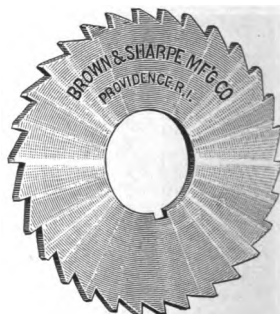
No.	Diameter.	Length of Cut.	Hole.	Hole tapped, threads per inch	Price.
F-200	2 1-2"	1 1-4"	1"	10	\$6 60
F-201	3	1 3-4	1 1-4	8	10 40
F-202	3 1-2	2	1 1-2	8	14 80
F-203	4	2	1 1-2	8	17 75
F-204	5	2	1 1-2	8	25 75
F-205	6	2	1 1-2	8	36 20

Number of Arbors on which Cutters can be used are as follows: F-200—Arbors 128, 129, 130, 131, 132, 133, 134, 135, 138 and 139. F-201—Arbors 142, 143, 146, 147, 150, 151, 154 and 155. F-202, F-203, F-204, F-205—Arbors 158, 159, 162, 163, 166, 167, 170 and 171. For list of Arbors, see pages 302, 303.

## Metal Slitting Saws.

These are thin Milling Cutters. They are ground on the sides and left a little thicker at the outer edge than near the centre to give a proper clearance in cutting deep slots.

In ordering *special* saws please state for what purpose they are required.



No.	Diameter.	Thickness.	Hole.	Price per Cutter.	
				Carbon Steel.	High Speed Steel.
G-50	2 1-2"	1-32"	7-8"	\$1 00	\$2 50
G-51	2 1-2	3-64	7-8	95	2 40
G-52	2 1-2	1-16	7-8	90	2 35
G-53	2 1-2	3-32	7-8	90	2 35

List continued on next page.

For List of Keyways, see page 242.



## Metal Slitting Saws (Cont.)

No.	Diameter.	Thickness.	Hole.	Price per Cutter.	
				Carbon Steel.	High Speed Steel.
G-54	2 1-2"	1-8"	7-8"	\$0 90	\$2 35
G-55	2 1-2	5-32	7-8	1 10	2 60
G-56	3	1-32	1	1 25	2 95
G-57	3	3-64	1	1 10	2 60
G-58	3	1-16	1	1 00	2 50
G-59	3	3-32	1	1 00	2 50
G-60	3	1-8	1	1 00	2 50
G-61	3	5-32	1	1 15	2 85
G-62	4	1-32	1	2 25	4 60
G-63	4	3-64	1	1 45	3 15
G-64	4	1-16	1	1 25	2 95
G-65	4	3-32	1	1 20	2 85
G-66	4	1-8	1	1 20	2 85
G-67	4	5-32	1	1 40	3 45
G-68	4	3-16	1	1 60	3 45
G-69	5	1-16	1	1 80	3 85
G-70	5	3-32	1	1 50	3 35
G-71	5	1-8	1	1 50	3 35
G-72	5	1-8	1 1-4	1 50	3 35
G-73	5	1-8	1 1-2	1 50	3 35
G-74	5	5-32	1	1 90	4 30
G-75	5	3-16	1	2 30	4 30
G-76	6	1-16	1	4 00	7 50
G-77	6	3-32	1	3 00	5 85
G-78	6	1-8	1	2 70	5 35
G-78A	6	1-8	1 1-4	2 70	5 35
G-79	6	3-16	1 1-2	3 50	6 45
G-79A	6	3-16	1 3-4	3 50	6 45
G-80	6	3-16	1	3 50	6 45
G-81	7	1-16	1	7 50	11 00
G-82	7	3-32	1	4 50	8 35
G-83	7	1-8	1	3 80	7 20
G-83A	7	3-16	1 1-4	5 10	9 05
G-83B	7	3-16	1 1-2	5 10	9 05
G-83C	7	3-16	2	5 10	9 05
G-84	8	1-8	1	5 75	12 00
G-85	8	1-8	1 1-4	5 75	12 00
G-86	8	3-16	1 1-4	7 00	12 30
G-87	8	3-16	1 1-2	7 00	12 30

For List of Keyways, see page 242.

## Cutters for Sawing Bicycle Chain Links.

These cutters are especially adapted to run in gangs. Like metal slitting saws they are ground on the sides for clearance. They are .092" thick and made in two sizes, as follows: 3" diameter, 1" hole; and 3 1-4" diameter, 1 1-4" hole.

Price, \$1 00 each.

## Formed Saws for Slitting Copper.



These saws are designed especially for the slitting or sawing of metals that are of a soft or tenacious character and are superior to the ordinary saw usually employed for this purpose.

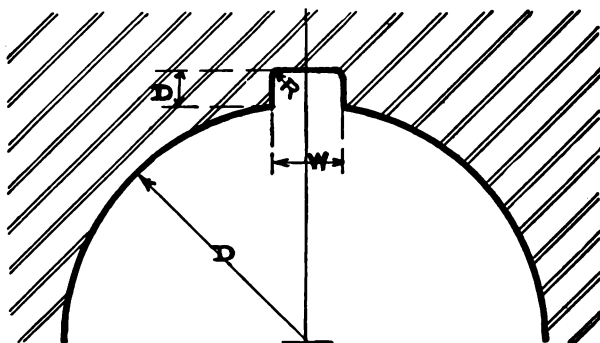
The teeth are backed off and formed the same as in all formed milling cutters, and are sharpened by grinding the face, thus retaining the outline of the saw. Each alternate tooth is V shaped and, as the others are flat, the chip is split and forced out sidewise, having less tendency to clog than where the ordinary saw is employed.

The sides of these saws are ground concave for clearance.

These saws are made to order of any desired size.

Prices on application.

## Standard Keyways for Cutters.



Diameter (D) of Hole.	Width (W) of Keyway.	Depth (D) of Keyway.	Radius (R).
3-8" to 9-16"	3-32"	3-64"	.020"
5-8 to 7-8 or 16 m/m to 21 m/m	1-8	1-16	.030
15-16 to 1 1-8 or 22 to 26	5-32	5-64	.035
1 3-16 to 1 3-8 or 27 to 31	3-16	3-32	.040
1 7-16 to 1 3-4* or 32 to 37	1-4	1-8	.050
1 13-16 to 2* or 38 to 44	5-16	5-32	.060
2 1-16 to 2 1-2 or 45	3-8	3-16	.060
2 9-16 to 3	7-16	3-16	.060

\*1 1-2", 1 3-4" and 2". For all Gear Cutters of these diameters, use 5-16", 3-8" and 1-2" keys, respectively.

Gear Cutters with 1 1-2" hole can also be furnished with 3-8" keyway.



## Screw Slotting Cutters.

These cutters have a fine pitch of teeth especially adapted for the slotting of screw heads and similar work.

They are not ground on the sides.

Cutters 2 3-4" diam. have 72 teeth, 2 1-4" diam. 60 teeth, and 1 3-4" diam. 90 teeth.

Catalogue No.	Diameter of Screw Head to be Slotted.	Gauge No. American Standard.	Thickness of Cutter in Decimals.	Diameter of Cutter.	Size of Hole.	Price Each.
H-10	1 5-16"	5	.182"	2 3-4"	1"	\$0 70
H-11	1 1-8	6	.162	2 3-4	1	60
H-12	1	7	.144	2 3-4	1	50
H-13	7-8	8	.128	2 3-4	3-4 & 1	45
H-14	3-4—13-16	9	.114	2 3-4	3-4 & 1	40
H-15	5-8	10	.102	2 3-4	3-4 & 1	35
H-16		11	.091	2 3-4	3-4 & 1	30
H-17	1-2—9-16	12	.081	2 3-4	3-4 & 1	25
H-18		13	.072	2 3-4	3-4 & 1	20
H-19	3-8—7-16	14	.064	2 3-4	1-2, 5-8, 3-4 & 1	20
H-20	11-32	15	.057	2 3-4	1-2, 5-8, 3-4 & 1	15
H-21	5-16	16	.051	2 3-4	1-2, 5-8, 3-4 & 1	15
H-22		17	.045	2 3-4	1-2, 5-8, 3-4 & 1	15
H-23	1-4—9-32	18	.040	2 3-4	1-2, 5-8, 3-4 & 1	15
H-24	3-16—7-32	19	.035	2 3-4	1-2, 5-8, 3-4 & 1	15
H-25		20	.032	2 3-4	1-2, 5-8, 3-4 & 1	15
H-26	1-8	21	.028	2 3-4	1-2, 5-8, 3-4 & 1	15
H-27	1-8	22	.025	2 3-4	1-2, 5-8, 3-4 & 1	15
H-28		23	.023	2 3-4	1-2, 5-8, 3-4 & 1	15
H-29		24	.020	2 3-4	1-2, 5-8, 3-4 & 1	15
H-30		25	.018	2 3-4	1-2, 5-8, 3-4 & 1	15
H-31		26	.016	2 3-4	1-2, 5-8, 3-4 & 1	15
H-32		27	.014	2 3-4	1-2, 5-8, 3-4 & 1	15
H-33		28	.012	2 3-4	1-2, 5-8, 3-4 & 1	15
H-34		30	.010	2 3-4	1-2, 5-8, 3-4 & 1	15
H-35		32	.008	2 3-4	1-2, 5-8, 3-4 & 1	15
H-36		34	.006	2 3-4	1-2, 5-8, 3-4 & 1	15
H-36A		10	.102	2 1-4	5-8	30
H-36B		11	.091	2 1-4	5-8	25
H-36C		12	.081	2 1-4	5-8	20
H-36D		13	.072	2 1-4	5-8	15
H-36E		14	.064	2 1-4	5-8	15

List continued on next page.

For List of Keyways, see page 242.

# Screw Slotting Cutters.

(Continued.)

Catalogue No.	Diameter of Screw Head to be Slotted.	Gauge No. American Standard.	Thickness of Cutter in Decimals.	Diameter of Cutter.	Size of Hole.	Price Each.
H-36F		15	.057"	2 1-4"	5-8"	\$0 15
H-36G		16	.051	2 1-4	5-8	15
H-36H		17	.045	2 1-4	5-8	15
H-36I		18	.040	2 1-4	5-8	15
H-36J		19	.035	2 1-4	5-8	15
H-37	3-16"	20	.032	2 1-4	1-2, 5-8 & 3-4	15
H-38	1-8	21	.028	2 1-4	1-2, 5-8 & 3-4	15
H-39		22	.025	2 1-4	1-2, 5-8 & 3-4	15
H-40		23	.023	2 1-4	1-2, 5-8 & 3-4	15
H-41		24	.020	2 1-4	1-2, 5-8 & 3-4	15
H-42		25	.018	2 1-4	1-2, 5-8 & 3-4	15
H-43		26	.016	2 1-4	1-2, 5-8 & 3-4	15
H-44		27	.014	2 1-4	1-2, 5-8 & 3-4	15
H-45		28	.012	2 1-4	1-2, 5-8 & 3-4	15
H-46		30	.010	2 1-4	1-2, 5-8 & 3-4	15
H-47		32	.008	2 1-4	1-2, 5-8 & 3-4	15
H-48		34	.006	2 1-4	1-2, 5-8 & 3-4	15
H-49	3-8	14	.064	1 3-4	5-8	15
H-50	11-32	15	.057	1 3-4	5-8	15
H-51	5-16	16	.051	1 3-4	5-8	15
H-52	9-32	17	.045	1 3-4	5-8	15
H-53	1-4	18	.040	1 3-4	5-8	15
H-54	7-32	19	.035	1 3-4	5-8	15
H-55	3-16	20	.032	1 3-4	5-8	15
H-56	1-8	21	.028	1 3-4	5-8	15
H-57		22	.025	1 3-4	5-8	15
H-58		23	.023	1 3-4	5-8	15
H-59		24	.020	1 3-4	3-8, 1-2 & 5-8	12
H-60		25	.018	1 3-4	3-8, 1-2 & 5-8	12
H-61		26	.016	1 3-4	3-8, 1-2 & 5-8	12
H-62		27	.014	1 3-4	3-8, 1-2 & 5-8	12
H-63		28	.012	1 3-4	3-8, 1-2 & 5-8	12
H-64		30	.010	1 3-4	3-8, 1-2 & 5-8	12
H-65		32	.008	1 3-4	3-8, 1-2 & 5-8	12
H-66		34	.006	1 3-4	3-8, 1-2 & 5-8	12

For Screw Slotting Cutter Arbors, see page 304.

Cutters varying from the list are made to order.

For List of Keyways, see page 242.

## Jewelers' Saws.

Many of the Screw Slotting Cutters listed above are suitable for jewelers' use in sawing chain links, etc.



## Angular Cutters.

These angular cutters of  $45^\circ$ ,  $50^\circ$ ,  $60^\circ$ ,  $70^\circ$  or  $80^\circ$  angle, both Right and Left hand, are suitable for cutting the teeth of cutters and mills.

No.	Diameter.	Thickness.	Hole.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
J-10	2 1-2"	1-2"	7-8"	\$2 65	\$4 10
J-11	2 3-4	1-2	1	2 80	4 45
J-12	3	1-2	1 1-4	3 35	5 40
J-13	3 1-4	1-2	1 1-2	3 75	6 15

For List of Keyways, see page 242.

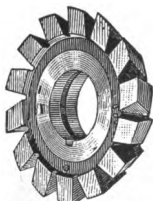
## Angular Cutters with Threaded Holes.

These cutters have an angle of  $60^\circ$  and are made both Right and Left hand.

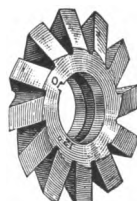
No.	Diameter.	Thickness.	Hole.	Thread.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
J-25	1 1-4"	7-16"	3-8"	20, L	\$2 25	\$3 15
J-26	1 5-8	9-16	1-2	16, L	2 50	3 50
*J-27	4	1 1-4	1 1-4	8, L	8 50	15 85

\*Left Hand only

## Angular Cutters and Cutters for Spiral Mills.



Right Hand Cutter.



These cutters can be sharpened by grinding without changing their form and are made to order.



## Angular Cutters

### With Side Ground Concave.

These Cutters have the side ground concave, and are made with 45°, 50°, 60°, 70° and 80° angle, both Right and Left hand.

In ordering, state whether Right or Left hand is wanted.

No.	Diameter.	Thickness.	Hole.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
J-50	2 1-2"	1-2"	7-8"	\$2 65	\$4 10
J-51	2 3-4	1-2	1	2 80	4 45
J-52	3	1-2	1 1-4	3 35	5 40
J-53	3 1-4	1-2	1 1-2	3 75	6 15



## Double Angle Cutters.

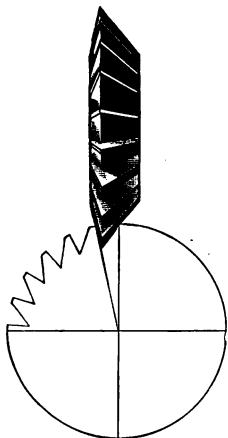
These Cutters are carried in stock with 45°, 60° or 90° included angle.

V shaped cutters of any angle made to order.

No.	Diameter.	Thickness.	Hole.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
J-100	2 1-2"	1-2"	7-8"	\$2 65	\$4 10
J-101	2 3-4	1-2	1	2 80	4 45
J-102	3	1-2	1 1-4	3 35	5 40

For List of Keyways, see page 242.

## Cutters for Spiral Mills.



These cutters are especially adapted to the cutting of spiral mills, and are made with either  $40^{\circ}$ ,  $48^{\circ}$  or  $53^{\circ}$  angle on one side and  $12^{\circ}$  on the other.

The cut illustrates a right hand cutter at work, in the position required in cutting the teeth of a spiral cutter.

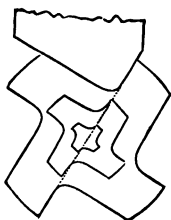
Right and left hand cutters carried in stock. In ordering specify.

No.	Diameter.	Thickness.	Hole.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
J-150	2 1-2"	1-2"	7-8"	\$2 65	\$4 10
J-151	2 3-4	1-2	1	2 80	4 45
J-152	3	1-2	1 1-4	3 35	5 40
*J-153	3 1-4	1-2	1 1-2	3 75	6 15

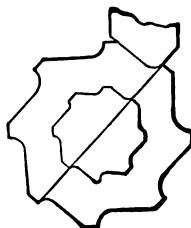
\*Can be furnished  $40^{\circ}$  on one side and  $12^{\circ}$  on the other, or  $53^{\circ}$  on one side and  $12^{\circ}$  on the other.

For List of Keyways, see page 242.

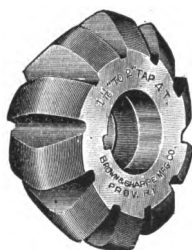
## Cutters for Grooving Taps and Reamers.



Form of Tap.



Form of Reamer.



## Cutters for Grooving Taps and Reamers.

Catalogue No.	Cutter No.	Diameter of Tap.	Number of Teeth in Tap.	Diameter of Cutter.	Hole in Cutter.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
L-10	1	0 to 1-8"	4	2"	1"	\$2 00	\$2 85
L-11	2	5-32" to 1-4	4	2	1	2 10	3 00
L-12	3	9-32 to 3-8	4	2 1-8	1	2 20	3 20
L-13	4	7-16 to 5-8	4	2 1-4	1	2 40	3 60
L-14	5	11-16 to 7-8	4	2 3-8	1	2 40	3 70
L-15	6	15-16 to 1 1-4	4	2 1-2	1	2 70	4 30
L-16	7	1 5-16 to 1 5-8	4	2 5-8	1	2 70	4 55
L-17	8	1 11-16 to 2	4	2 7-8	1	3 00	5 30

No. L-10 cutter is suitable for grooving taps 1-8" or less diameter; No. L-11 for taps larger than 1-8" and up to 1-4" diameter, &c. See cut on preceding page.

These cutters are also adapted for fluting reamers, for which purpose it is necessary only to cut one or more grooves of a less depth in order to flute unevenly. See cut on preceding page.

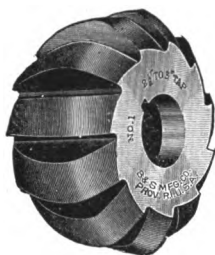
Catalogue No.	Cutter No.	Diameter of Reamer.	Number of Teeth in Reamer.	Diameter of Cutter.	Hole in Cutter.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
L-10	1	1-8" to 1-4"	6	2"	1"	\$2 00	\$2 85
L-11	2	9-32 to 3-8	6	2	1	2 10	3 00
L-12	3	13-32 to 1-2	6	2 1-8	1	2 20	3 20
L-13	4	17-32 to 1 1-8	6 to 8	2 1-4	1	2 40	3 60
L-14	5	1 5-32 to 1 3-4	8 to 10	2 3-8	1	2 40	3 70
L-15	6	1 25-32 to 2	10	2 1-2	1	2 70	4 30
L-16	7	2 1-16 to 2 1-2	10	2 5-8	1	2 70	4 55
L-17	8	2 9-16 to 3	10	2 7-8	1	3 00	5 30

These cutters can be sharpened by grinding without changing their form.

In ordering, give number of cutter, or diameter and number of teeth of tap or reamer as by above lists.

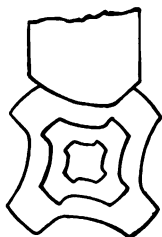
For List of Keyways, see page 242.





## Cutters for Grooving Taps.

Catalogue No.	Cutter No.	Diameter of Tap.	Diameter of Cutter.	Hole in Cutter.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
L-50	1	0 to 1-8"	2"	1"	\$2 00	\$2 85
L-51	2	5-32 to 1-4	2	1	2 10	3 00
L-52	3	9-32 to 3-8	2 1-8	1	2 20	3 15
L-53	4	7-16 to 5-8	2 1-4	1	2 40	3 55
L-54	5	11-16 to 7-8	2 3-8	1	2 40	3 70
L-55	6	15-16 to 1 1-4	2 1-2	1	2 70	4 30
L-56	7	1 5-16 to 1 5-8	2 5-8	1	2 70	4 45
L-57	8	1 11-16 to 2	2 7-8	1	3 00	5 25
L-58	9	2 1-16 to 2 7-16	3 1-8	1	3 40	5 50
L-59	10	2 1-2 to 3	3 3-8	1	3 80	6 00



Form of Tap.

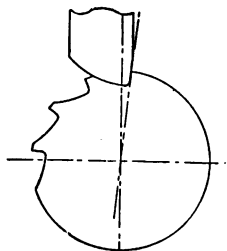
We make a style of cutter adapted to grooving taps only. These cutters do not make so deep a groove in proportion to the width as the tap and reamer cutters. They are not suitable for fluting reamers. See cut.

These cutters can be sharpened by grinding without changing their form.

In ordering, give number of cutter or diameter of tap, as by above list.

For List of Keyways, see page 242.

## Cutters for Fluting Reamers.

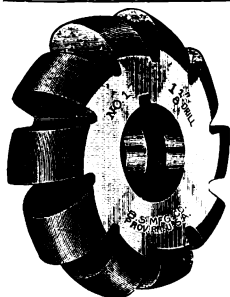


The cut shows a form of cutter that makes a tooth that allows the chips to be removed more readily and has greater strength than the form made by the cutters for grooving taps and reamers.

In ordering, give number of cutter or diameter of reamer by the following list.

Catalogue No.	Cutter No.	Diameter of Reamer.	Number of Teeth.	Hole in Cutter.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
L-75	1	1-8" to 3-16"	6	1"	\$2 00	\$3 10
L-76	2	1-4 to 5-16	6	1	2 10	3 10
L-77	3	3-8 to 7-16	6	1	2 20	3 30
L-78	4	1-2 to 11-16	6 to 8	1	2 40	3 60
L-79	5	3-4 to 1	8	1	2 40	3 75
L-80	6	1 1-16 to 1 1-2	10	1	2 70	4 15
L-81	7	1 9-16 to 2 1-8	12	1	2 70	4 30
L-82	8	2 1-4 to 3	14	1	3 00	4 75
L-83	9	3 1-16 to 3 1-2	14	1	3 30	5 20
L-84	10	3 9-16 to 5	14 to 16	1	3 70	5 70

For List of Keyways, see page 242.

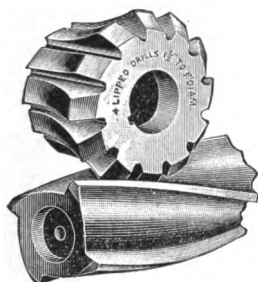


## Cutters for Making Twist Drills.

These cutters can be sharpened by grinding without changing their form.

In ordering, give number of cutter or diameter of drill by the following list.

Catalogue No.	Cutter No.	Diameter of Drill.	Dia. of Circle made by Cutter.	Diameter of Cutter.	Hole in Cutter.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
L-100	1	1-16"	.06"	2"	1"	\$1 50	\$2 15
L-101	2	1-8	.08	2	1	1 70	2 40
L-102	3	3-16	.11	2	1	1 90	2 70
L-103	4	1-4	.15	2	1	2 10	3 00
L-104	5	5-16	.19	2 1-4	1	2 30	3 35
L-105	6	3-8	.23	2 1-4	1	2 40	3 50
L-106	7	7-16	.27	2 1-4	1	2 60	3 80
L-107	8	1-2	.31	2 1-4	1	2 80	4 10
L-108	9	9-16	.35	2 3-8	1	3 00	4 45
L-109	10	5-8	.39	2 3-8	1	3 20	4 75
L-110	11	11-16	.44	2 3-8	1	3 40	5 05
L-111	12	3-4	.50	2 1-2	1	3 60	5 40
L-112	13	13-16	.56	2 1-2	1	3 80	5 70
L-113	14	7-8	.62	2 3-4	1	4 00	6 20
L-114	15	15-16	.70	2 3-4	1	4 20	6 55
L-115	16	1	.77	3	1	4 50	7 20
L-116	17	1 1-8	.85	3	1	5 00	8 20



## Cutters for Making Four Lipped Twist Drills.

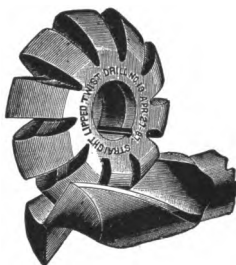
These cutters are especially adapted to cutting Four Lipped Twist Drills that are used in screw and chucking machines for roughing out holes previous to reaming, and can be sharpened by grinding without changing their form.

In ordering, give number of cutter or size of drill by the following list.

Catalogue No.	Cutter No.	Diameter of Drill.	Diameter of Cutter.	Hole.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
L-250	1	To 1 1-2"	2 3-4"	1"	\$6 00	\$9 55
L-251	2	1 1-2 to 3	3	1	7 00	12 40

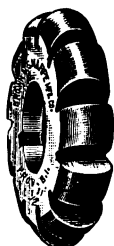
For List of Keyways, see page 242.

## Cutters for Making Straight Lipped Twist Drills.



Catalogue No.	Cutter No.	Diameter of Drill.	Diameter of Cutter.	Hole in Cutter.	Carbon Steel Cutters Price each.	High Speed Steel Cutters Price each.
L-200	1	1-16"	2"	1"	\$1 50	\$2 20
L-201	2	1-8	2	1	1 70	2 50
L-202	3	3-16	2	1	1 90	2 80
L-203	4	1-4	2	1	2 10	3 10
L-204	5	5-16	2 1-4	1	2 30	3 40
L-205	6	3-8	2 1-4	1	2 40	3 60
L-206	7	7-16	2 1-4	1	2 60	3 90
L-207	8	1-2	2 1-4	1	2 80	4 20
L-208	9	9-16	2 5-8	1	3 00	4 40
L-209	10	5-8	2 5-8	1	3 20	4 95
L-210	11	11-16	2 5-8	1	3 40	5 25
L-211	12	3-4	2 5-8	1	3 60	5 55
L-212	13	13-16	2 7-8	1	3 80	6 00
L-213	14	7-8	2 7-8	1	4 00	6 35
L-214	15	15-16	2 7-8	1	4 20	6 65
L-215	16	1	3	1	4 50	7 30
L-216	17	1 1-8	3	1	5 00	8 10
L-217	18	1 1-4	3 1-4	1	5 50	9 15
L-218	19	1 1-2	3 3-4	1 1-4	6 25	11 15
L-219	20	1 3-4	3 3-4	1 1-4	7 00	12 55
L-220	21	2	4	1 1-4	7 75	14 55
L-221	22	2 1-4	4 1-4	1 1-4	8 50	16 50
L-222	23	2 1-2	4 1-2	1 1-4	9 25	18 60

These cutters can be sharpened by grinding without changing their form.  
 In ordering, give number of cutter or diameter of drill by above list.  
 For List of Keyways, see page 242.



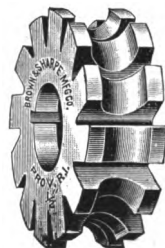
Convex.

# Convex and Concave Cutters.

## For Milling Half Circles.

These cutters can be sharpened by grinding without changing their outline.

### CONVEX.



Concave.

No.	Diameter of Circle.	Diameter of Cutter.	Size of Hole.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
C-10	1-8"	2"	7-8"	\$2 00	\$2 85
C-11	3-16	2	7-8	2 25	2 90
C-12	1-4	2	7-8	2 50	3 20
C-13	5-16	2 1-4	7-8	2 80	4 10
C-14	3-8	2 1-4	7-8	3 10	4 55
C-15	7-16	2 1-4	7-8	3 35	4 95
C-16	1-2	2 1-4	7-8	3 60	5 35
C-17	5-8	2 3-4	1	4 00	5 95
C-18	3-4	3	1	4 40	7 10
C-19	7-8	3 1-4	1	4 80	8 00
C-20	1	3 1-4	1	5 25	8 80
C-21	1 1-8	4	1 1-4	5 75	9 90
C-22	1 1-4	4	1 1-4	6 25	10 80
C-23	1 3-8	4 1-4	1 1-4	7 00	12 20
C-24	1 1-2	4 1-4	1 1-4	7 75	13 90

### CONCAVE.

No.	Diameter of Circle.	Diameter of Cutter.	Size of Hole.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
C-10A	1-8"	2"	7-8"	\$2 40	\$3 50
C-11A	3-16	2	7-8	2 70	3 95
C-12A	1-4	2	7-8	3 00	4 40
C-13A	5-16	2 1-4	7-8	3 35	5 00
C-14A	3-8	2 1-4	7-8	3 70	5 55
C-15A	7-16	2 1-4	7-8	4 00	6 00
C-16A	1-2	2 1-4	7-8	4 30	6 50
C-17A	5-8	2 3-4	1	4 80	7 85
C-18A	3-4	3	1	5 25	8 75
C-19A	7-8	3 1-4	1	5 75	10 00
C-20A	1	3 1-4	1	6 30	11 00
C-21A	1 1-8	4	1 1-4	6 90	12 50
C-22A	1 1-4	4	1 1-4	7 50	13 60
C-23A	1 3-8	4 1-4	1 1-4	8 40	15 70
C-24A	1 1-2	4 1-4	1 1-4	9 30	17 25

For List of Keyways, see page 242.

# Convex Cutters

## AND

# Interlocking Concave Cutters.



These cutters have  
plain or milling  
cutter teeth.



### CONVEX.

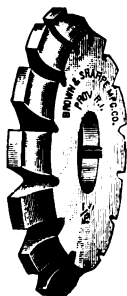
No.	Diameter of Circle.	Diameter of Cutter.	Size of Hole.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
C-50	3-8"	2 1-4"	7-8"	\$3 10	\$7 25
C-51	1-2	2 1-4	7-8	3 60	8 00
C-52	5-8	2 3-4	1	4 00	9 15
C-53	3-4	3	1	4 40	9 85
C-54	7-8	3 1-4	1	4 80	11 25
C-55	1	3 1-4	1	5 25	11 95
C-56	1 1-8	3 1-2	1	5 75	13 40
C-57	1 1-4	3 1-2	1	6 25	14 50
C-58	1 3-8	3 3-4	1	7 00	16 05
C-59	1 1-2	3 3-4	1	7 75	17 25

### INTERLOCKING CONCAVE.

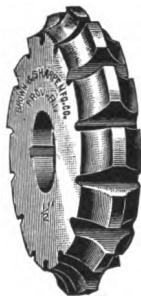
No.	Diameter of Circle.	Diameter of Cutter.	Size of Hole.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
C-50A	3-8"	2 1-4"	7-8"	\$5 25	\$10 20
C-51A	1-2	2 1-4	7-8	6 10	11 00
C-52A	5-8	2 3-4	1	6 80	12 40
C-53A	3-4	3	1	7 50	14 00
C-54A	7-8	3 1-4	1	8 15	15 40
C-55A	1	3 1-4	1	8 90	15 75
C-56A	1 1-8	3 1-2	1	9 75	18 75
C-57A	1 1-4	3 1-2	1	10 60	20 40
C-58A	1 3-8	3 3-4	1	11 90	22 80
C-59A	1 1-2	3 3-4	1	13 15	24 65

For List of Keyways, see page 242.

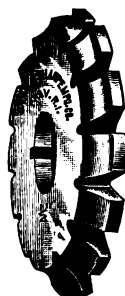
## Corner-Rounding Cutters.



Left Hand.



Double.



Right Hand.

These cutters have side as well as radial clearance and can be ground without changing their outline.

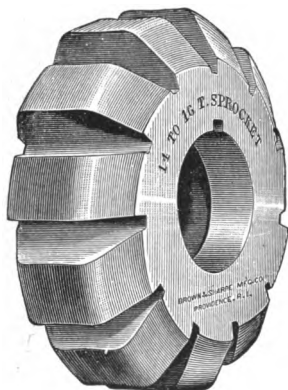
In ordering single cutters, state whether Right or Left Hand is wanted.

No.	Radius of Circle.	Diameter.	Hole.	Carbon Steel Cutters.		High Speed Steel Cutters.	
				Price, Single Cutter.	Price, Double Cutter.	Price, Single Cutter.	Price, Double Cutter.
C-100	1-16"	2"	7-8"	\$2 00	\$2 40	\$2 90	\$3 50
C-101	3-32	2	7-8	2 25	2 70	3 30	3 95
C-102	1-8	2	7-8	2 50	3 00	3 65	4 40
C-103	5-32	2 1-4	7-8	2 70	3 35	4 05	4 95
C-104	3-16	2 1-4	7-8	2 90	3 70	4 35	5 50
C-105	7-32	2 1-4	7-8	3 10	4 00	4 65	6 00
C-106	1-4	2 1-4	7-8	3 30	4 30	4 95	6 45
C-107	5-16	2 3-4	1	3 50	4 80	5 70	7 65
C-108	3-8	3	1	3 70	5 25	5 90	8 65
C-109	7-16	3 1-4	1	3 90	5 75	6 35	9 75
C-110	1-2	3 1-4	1	4 20	6 30	6 80	11 00
C-111	9-16	3 1-2	1	4 50	6 90	8 10	12 45
C-112	5-8	3 1-2	1	5 00	7 50	9 00	13 50
C-113	11-16	3 3-4	1	5 75	8 40	10 40	15 40
C-114	3-4	3 3-4	1	6 50	9 30	11 80	17 00

For List of Keyways, see page 242.

# Sprocket Wheel Cutters

## FOR BLOCK CENTRE CHAINS.



We carry in stock a form of Sprocket Wheel Cutter for the ordinary 1" pitch chain.

The cutters for the smaller sized wheels are for cutting a curved form of tooth, to prevent the chain from mounting the sprocket, while the cutters for the larger sized wheels make a straight sided tooth.

Cutters of special forms, or to cut two teeth at one time, are made to order.

No. of Teeth of Sprocket.	Diameter of Cutter.	Hole.	Carbon Steel Cutters. Price Single Cutter.	High Speed Steel Cutters. Price Single Cutter.
6	2 3-4"	1"	\$6 00	\$9 45
7	2 3-4	1	6 00	9 45
8	2 3-4	1	6 00	9 45
9	2 3-4	1	6 00	9 45
10 and 11	2 3-4	1	6 00	9 45
12 and 13	2 3-4	1	6 00	9 45
14 to 16	2 3-4	1	6 00	9 45
17 to 20	2 3-4	1	6 00	9 45
21 and over	2 3-4	1	6 00	9 45

Double Cutters, Carbon Steel, \$13 00 per pair.

Double Cutters, High Speed Steel, \$20 00 per pair.

## Special Sprocket Wheel Cutters for Block Centre Chains.

Circular Pitch.	Thickness of Block.	Diameter of Cutter.	Centre to Centre of Block.	Hole in Cutter.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
1 5-16"	.4375"	3 1-2"	.5313"	1 1-4"	\$7 50	\$12 90
1 1-2	17-32	3 3-4	.5625	1 1-4	8 00	14 35

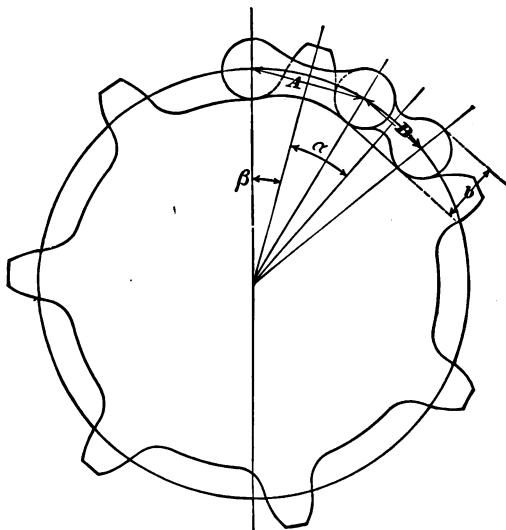
Seven Cutters are made for each pitch, for Nos. of teeth as follows: 8, 9, 10 and 11, 12 and 13, 14 to 16, 17 to 20, 21 and over.

These Special Cutters are not carried in stock, but can be furnished at short notice.



## Formula

### For Calculating Diameters of Sprocket Wheels for Block Centre Chains.



$N$  = No. of Teeth.

$b$  = Diameter of Round Part of Chain Block.

$B$  = Centre to Centre of holes in Chain Block.

$A$  = Centre to Centre of holes in Side Links.

$$\alpha = \frac{180^\circ}{N}$$

$$\tan. \beta = \frac{\sin. \alpha}{\frac{B}{A} + \cos. \alpha}$$

$$\text{Pitch Diam.} = \frac{A}{\sin. \beta}$$

$$\text{Outside Diameter} = \text{Pitch Diameter} + b$$

$$\text{Bottom Diameter} = \text{Pitch Diameter} - b$$

In calculating the diameter of Sprocket Wheels the Bottom Diameter is the most important.

# Sprocket Wheel Cutters

## For Roller Chains.

We furnish at short notice Sprocket Wheel Cutters for Roller Chains.

Circular Pitch.	Diameter of Rolls.	Diameter of Cutter.	Hole in Cutter.	Carbon Steel Cutters. Price each.	High Speed Steel Cutters. Price each.
1-2"	.306" or .308"	2 7-8"	1"	\$6 00	\$9 00
5-8	.401	3	1	6 25	9 60
3-4	*.47	3 1-4	1	6 50	10 30
15-16	.5625	3 3-8	1	7 00	11 65
1	.5625 or *.625	3 1-2	1	7 00	11 65
1 1-4	.625 or *.750	3 3-4	1 1-4	7 50	12 95
1 1-2	.75 or *.875	4 1-2	1 1-4	8 00	14 85
1 3-4	*1.	4 3-4	1 1-4	10 00	20 00
2	*1.125	5	1 1-4	12 00	24 00

\*"Whitney Standard."

Nine Cutters are made for each pitch, for Nos. of teeth as follows: 8, 9, 10 and 11, 12 and 13, 14 to 16, 17 to 20, 21 to 34, 35 to 79, 80 and over.

In ordering, specify the number of teeth in the sprocket, and the diameter of the roller.

## Formula

### For Calculating Diameters of Sprocket Wheels for Roller Chains.

N = Number of Teeth in Sprocket.

P = Pitch of Chain.

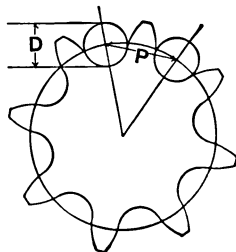
D = Diameter of Roller.

$$\alpha = \frac{180^\circ}{N}$$

$$\text{Pitch Diameter} = \frac{P}{\sin. \alpha}$$

Outside Diameter = Pitch Diameter + D.

Bottom Diameter = Pitch Diameter - D.



# Diameter of Sprocket Wheels.

FOR BLOCK CHAINS 1' PITCH.

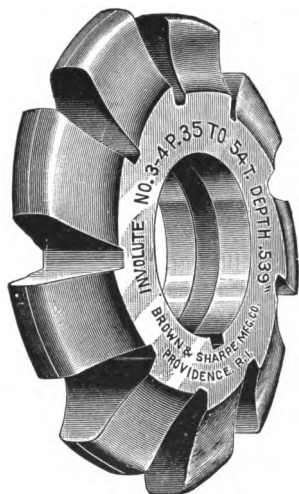
$$A = .6" \quad B = .4" \quad b = .325".$$

No. of Teeth.	Pitch Diameter.	Outside Diameter.	Bottom Diameter.
6	1.935"	2.260"	1.610"
7	2.250	2.575	1.925
8	2.566	2.891	2.241
9	2.882	3.207	2.557
10	3.198	3.523	2.873
11	3.515	3.840	3.190
12	3.832	4.157	3.507
13	4.149	4.474	3.824
14	4.466	4.791	4.141
15	4.784	5.109	4.459
16	5.102	5.427	4.777
17	5.420	5.745	5.095
18	5.738	6.063	5.413
19	6.056	6.381	5.731
20	6.374	6.699	6.049
21	6.692	7.017	6.367
22	7.010	7.335	6.685
23	7.328	7.653	7.003
24	7.646	7.971	7.321
25	7.964	8.289	7.639
26	8.282	8.607	7.957
27	8.600	8.925	8.275
28	8.918	9.243	8.593
29	9.237	9.562	8.912
30	9.556	9.881	9.231

For List of Sprocket Wheel Cutters, see page 256.

## Patent Cutters

**For the Teeth of Gear Wheels,  
which can be  
Sharpened by Grinding Without Changing Their Form.**



The Patent Cutters for the teeth of Gear Wheels, from their peculiar construction, can be sharpened by grinding the faces of the teeth. This operation can be repeated without altering the form of the tooth which the cutter makes, thereby rendering them much more valuable than cutters of ordinary form.

Cutters marked \* are not kept in stock, but are made to order at short notice.

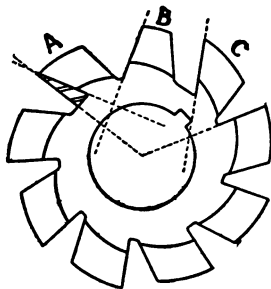
Orders should be given by annexed tables, stating the No. of cutter and the diametral pitch required. By diametral pitch is meant the number of teeth to the inch in diameter on pitch circle of any wheel. In ordering cutters for worm wheels, give the number of teeth in wheel, the diameter of worm and number of threads to the inch.

**Centre Line on Gear Cutters.** We call attention to the centre line on our Gear Cutters, which is convenient in setting cutters central with the work spindle.

## Sharpening Gear and Formed Cutters.

For economy, cutters must be kept well sharpened. Sharp cutters give faster production, consume less power, produce better surfaces and wear longer. Use a bevel and concave wheel of medium grain and soft grade, just hard enough to prevent the grit flying about. Keep the wheel clean, as a glazed wheel draws the cutter temper, also keep the corner sharp to give a true surface the entire length of the cutter tooth.

In grinding the Cutter, the face of every tooth must be kept radial and all must be of the same height. When not ground radial they are either "hooking" like C which cuts too deep, or "dragging" as B which cuts too shallow. Besides this, all cutter teeth are relieved so that the cutting outline of the tooth only remains correct when ground radial. Hence such teeth as A, B and C will cut gear teeth of the wrong shape. Be careful also to keep each tooth face square with the sides of the cutter, avoiding mistakes like A. If some of the teeth are longer than others the long teeth will do all the cutting.



## To Set a Gear Cutter Central.

The indicator furnished with our Automatic Gear Cutting Machine allows settings sufficiently accurate for ordinary work. When a very accurate and quiet running gear is required, however, it is absolutely essential that the cutter be exactly central.

The best method of setting the cutter central is first to turn a blank identical in diameter with the gear to be cut, and after centering it as nearly as possible, take a single cut through the blank. Without changing the position of the cutter, remove the blank from the work arbor and turn it end for end. Leave the blank loose on the arbor and feed the cutter into the slot already cut. Then revolve the cutter by pulling the belt so as to mark its position in relation to the slot produced at the first cut.

If the cutter is exactly central, the second cut will follow the outline of the first; but if out of centre the cutter at its second passage will cut some stock from the top of the space on one side and from the bottom on the other side. In the latter case the cutter should be moved laterally away from the side of the tooth from which the stock was taken at the deepest part of cut and another cut taken in another part of the blank, and the above operations repeated until the cutter is properly centered.

# Patent Involute Cutters

## For Teeth of Gear Wheels.

Eight Cutters are made for each pitch, as follows:

No. 1	will cut wheels from 135 teeth to a rack.
" 2	" " " " 55 " " 134 teeth.
" 3	" " " " " 35 " " 54 "
" 4	" " " " " 26 " " 34 "
" 5	" " " " " 21 " " 25 "
" 6	" " " " " 17 " " 20 "
" 7	" " " " " 14 " " 16 "
" 8	" " " " " 12 " " 13 "

We are prepared to furnish to order Gear Cutters from 2 to 8 pitch inclusive of half numbers, for the accommodation of those who require a finer division of the number of teeth to be cut with each cutter than can be cut with the regular number.

The Nos. 1 to 8, as listed above, are the regular cutters as furnished heretofore. The half numbers are as follows:

No. of Cutter.	Range.	No. of Cutter.	Range.
1 1-2	80 to 134 teeth.	5 1-2	19 to 20 teeth.
2 1-2	42 " 54 "	6 1-2	15 " 16 "
3 1-2	30 " 34 "	7 1-2	13
4 1-2	23 " 25 "		

Prices for half numbers on application.

In ordering, give the No. of Cutter and Diametral Pitch required. Cutters in stock can be ordered by telegraph.

**Form of Telegram:**—"Send one Cutter No. five, eight pitch (Carbon Steel or High Speed Steel)."

When ordering Cutters for Bevel Gears note instructions given on pages 267 and 268.

# Patent Involute Cutters for Teeth of Gear Wheels.

All Gears of same pitch cut with these Cutters are interchangeable.

Pitch.	Diameter of Cutter.		Size of Hole.	Price per Cutter.	
	Carbon Steel.	High Spd.Steel		Carbon Steel.	High Spd.Steel
*1	8 1-2"	8 1-2"	2"	\$45 00	\$85 00
*1 1-4	7 3-4	7 3-4	2	38 00	70 00
*1 1-2	7	7	1 3-4	32 00	55 00
1 3-4	6 1-2	6 1-2	1 3-4	24 00	45 00
2	5 3-4	5 3-4	1 1-2	16 00	35 00
*2 1-4	5 3-4	5 3-4	1 1-2	13 00	28 00
2 1-2	5 1-2	5 3-4	1 1-2	11 00	23 00
*2 3-4	5 1-8	5 1-2	1 1-2	10 00	20 00
3	4 3-8	4 3-4	1 1-4	8 00	18 00
*3 1-4	4 1-4	4 5-8	1 1-4	7 00	16 00
*3 1-2	4 1-8	4 1-2	1 1-4	6 75	14 00
*3 3-4	4	4 3-8	1 1-4	6 50	13 00
4	3 7-8	4 1-4	1 1-4	6 00	12 00
*4 1-2	3 3-4	4	1 1-4	5 50	11 00
5	3 5-8	3 3-4	1 1-4	5 00	10 00
*5 1-2	3 5-8	3 3-4	1 1-4	5 00	9 00
6	3	3 1-8	1	4 30	8 00
7	2 7-8	2 7-8	1	4 10	7 00
8	2 7-8	2 7-8	1	3 90	6 00
9	2 3-4	2 3-4	1	3 70	5 50
10	2 1-4	2 3-8	7-8	3 50	5 00
11	2 1-4	2 3-8	7-8	3 30	4 50
12	2 1-8	2 1-4	7-8	3 10	4 25
*13	2 1-8	2 1-4	7-8	2 90	4 00
14	2	2 1-8	7-8	2 70	3 75
*15	2	2 1-8	7-8	2 60	3 60
16	2	2 1-8	7-8	2 50	3 50
18	1 7-8	2	7-8	2 40	3 40
20	1 7-8	2	7-8	2 30	3 30
22	1 7-8	2	7-8	2 20	3 20
24	1 3-4	1 3-4	7-8	2 10	3 10
26	1 3-4	1 3-4	7-8	2 00	3 00
28	1 3-4	1 3-4	7-8	1 80	3 00
30	1 3-4	1 3-4	7-8	1 80	3 00
32	1 3-4	1 3-4	7-8	1 80	3 00
*34	1 3-4	1 3-4	7-8	1 80	3 00
36	1 3-4	1 3-4	7-8	1 80	3 00
*38	1 3-4	1 3-4	7-8	1 80	3 00
40	1 3-4	1 3-4	7-8	1 80	3 00
*44	1 3-4	1 3-4	7-8	1 80	3 00
48	1 3-4	1 3-4	7-8	1 80	3 00
*50	1 3-4	1 3-4	7-8	1 80	3 00
*56	1 3-4	1 3-4	7-8	1 80	3 00
*60	1 3-4	1 3-4	7-8	1 80	3 00
*64	1 3-4	1 3-4	7-8	1 80	3 00
*70	1 3-4	1 3-4	7-8	1 80	3 00
*80	1 3-4	1 3-4	7-8	1 80	3 00
*120	1 3-4	1 3-4	7-8	1 80	3 00

Cutters marked \* are not kept in stock, but are made to order.

Eight Cutters made for each pitch; see page 262. For List of Keyways, see page 242.



# Patent Involute Cutters

FOR TEETH OF GEAR WHEELS.

FOR USE ON

No. 3 Automatic Gear Cutting Machines.

Pitch.	Diameter of Cutter.		Hole.	Keyway.	Price per Cutter.	
	Carbon Steel.	High Speed Steel.			Carbon Steel.	High Speed Steel.
4	3 1-2"	3 5-8"	1"	5-32 x 5-64"	\$5 50	\$12 00
*4 1-2	3 3-8	3 1-2	1	5-32 x 5-64	5 00	11 00
5	3 1-4	3 3-8	1	5-32 x 5-64	4 75	10 00
*5 1-2	3 1-8	3 1-4	1	5-32 x 5-34	4 50	9 00
6	3	3 1-8	1	5-32 x 5-64	4 30	8 00
7	2 7-8	2 7-8	1	5-32 x 5-64	4 10	7 00
8	2 7-8	2 7-8	1	5-32 x 5-64	3 90	6 00
9	2 3-4	2 3-4	1	5-32 x 5-64	3 70	5 50
10	2 3-4	2 3-4	1	5-32 x 5-64	3 60	5 30
11	2 5-8	2 5-8	1	5-32 x 5-64	3 50	4 95
12	2 5-8	2 5-8	1	5-32 x 5-64	3 35	4 70
*13	2 5-8	2 5-8	1	5-32 x 5-64	3 15	4 40
14	2 1-2	2 1-2	1	5-32 x 5-64	2 95	4 15
*15	2 1-2	2 1-2	1	5-32 x 5-64	2 85	4 00
16	2 1-2	2 1-2	1	5-32 x 5-64	2 75	3 85
18	2 3-8	2 3-8	1	5-32 x 5-64	2 65	3 75
20	2 3-8	2 3-8	1	5-32 x 5-64	2 55	3 65
22	2 1-4	2 1-4	1	5-32 x 5-64	2 45	3 55
24	2 1-4	2 1-4	1	5-32 x 5-64	2 35	3 45
*26	2 1-4	2 1-4	1	5-32 x 5-64	2 25	3 30
*28	2 1-4	2 1-4	1	5-32 x 5-64	2 05	3 30
*30	2 1-4	2 1-4	1	5-32 x 5-64	2 05	3 30
*32	2 1-4	2 1-4	1	5-32 x 5-64	2 05	3 30
*34	2 1-4	2 1-4	1	5-32 x 5-64	2 05	3 30
*36	2 1-4	2 1-4	1	5-32 x 5-64	2 05	3 30
*38	2 1-4	2 1-4	1	5-32 x 5-64	2 05	3 30
*40	2 1-4	2 1-4	1	5-32 x 5-64	2 05	3 30
*44	2 1-4	2 1-4	1	5-32 x 5-64	2 05	3 30
*48	2 1-4	2 1-4	1	5-32 x 5-64	2 05	3 30

Cutters marked \* are not kept in stock, but are made to order.

Eight cutters made for each pitch, see page 262.

3 pitch and coarser in Cast Iron and 4 pitch and coarser in Steel, require 2 cuts to insure accuracy.

For List of Keyways, see page 242.

**KEEP CUTTERS SHARP.**



# Patent Involute Cutters for Teeth of Gear Wheels.

FOR USE ON  
Nos. 3H & 4 Automatic Gear Cutting Machines.

Pitch.	Diameter of Cutter.		Hole.	Keyway.	Price of Cutter.	
	Carbon Steel.	HighSp.Steel			Carbon Steel.	HighSp.Steel
3	4 3-8"	4 3-4"	1 1-4"	3-16 x 3-32"	\$8 00	\$18 00
*3 1-4	4 1-4	4 5-8	1 1-4	3-16 x 3-32	7 00	16 00
*3 1-2	4 1-8	4 1-2	1 1-4	3-16 x 3-32	6 75	14 00
*3 3-4	4	4 3-8	1 1-4	3-16 x 3-32	6 50	13 00
4	3 7-8	4 1-4	1 1-4	3-16 x 3-32	6 00	12 00
*4 1-2	3 3-4	4	1 1-4	3-16 x 3-32	5 50	11 00
5	3 5-8	3 3-4	1 1-4	3-16 x 3-32	5 00	10 00
*5 1-2	3 5-8	3 3-4	1 1-4	3-16 x 3-32	5 00	9 00
6	3 1-2	3 1-2	1 1-4	3-16 x 3-32	4 80	8 40
7	3 3-8	3 3-8	1 1-4	3-16 x 3-32	4 60	8 00
8	3 1-4	3 1-4	1 1-4	3-16 x 3-32	4 40	7 30
9	3 1-8	3 1-8	1 1-4	3-16 x 3-32	4 20	6 65
10	3	3	1 1-4	3-16 x 3-32	4 00	6 00
11	2 7-8	2 7-8	1 1-4	3-16 x 3-32	3 80	5 40
12	2 7-8	2 7-8	1 1-4	3-16 x 3-32	3 60	5 10
*13	2 7-8	2 7-8	1 1-4	3-16 x 3-32	3 40	4 80
*14	2 7-8	2 7-8	1 1-4	3-16 x 3-32	3 20	4 50
*15	2 7-8	2 7-8	1 1-4	3-16 x 3-32	3 10	4 35
*16	2 7-8	2 7-8	1 1-4	3-16 x 3-32	3 00	4 20
*18	2 7-8	2 7-8	1 1-4	3-16 x 3-32	2 90	4 10
*20	2 3-4	2 3-4	1 1-4	3-16 x 3-32	2 80	4 00

## FOR USE ON No. 5 Automatic Gear Cutting Machines.

Pitch.	Diameter of Cutter.		Hole.	Keyway.	Price of Cutter.	
	Carbon Steel.	HighSp.Steel			Carbon Steel.	HighSp.Steel
2	5 3-4"	5 3-4"	1 1-2"	5-16 x 5-32"	\$16 00	\$35 00
*2 1-4	5 3-4	5 3-4	1 1-2	5-16 x 5-32	13 00	28 00
2 1-2	5 1-2	5 3-4	1 1-2	5-16 x 5-32	11 00	23 00
*2 3-4	5 1-8	5 1-2	1 1-2	5-16 x 5-32	10 00	20 00
3	5	5 1-4	1 1-2	5-16 x 5-32	9 00	19 00
*3 1-4	4 3-4	5	1 1-2	5-16 x 5-32	8 00	17 80
*3 1-2	4 5-8	4 7-8	1 1-2	5-16 x 5-32	7 50	15 40
*3 3-4	4 3-8	4 5-8	1 1-2	5-16 x 5-32	7 00	14 30
4	4 1-4	4 1-2	1 1-2	5-16 x 5-32	6 50	13 20
*4 1-2	4 1-8	4 3-8	1 1-2	5-16 x 5-32	6 00	12 10
5	4	4 1-4	1 1-2	5-16 x 5-32	5 50	11 00
*5 1-2	3 7-8	4 1-8	1 1-2	5-16 x 5-32	5 50	10 00
6	3 3-4	3 7-8	1 1-2	5-16 x 5-32	5 30	9 00
7	3 5-8	3 5-8	1 1-2	5-16 x 5-32	5 10	8 25
8	3 1-2	3 1-2	1 1-2	5-16 x 5-32	4 90	7 50
*9	3 1-2	3 1-2	1 1-2	5-16 x 5-32	4 70	7 00
*10	3 1-2	3 1-2	1 1-2	5-16 x 5-32	4 70	6 50

Cutters marked \* are not kept in stock but are made to order.  
Eight cutters made for each pitch, page 262. 3 pitch and coarser in Cast Iron and 4 pitch  
and coarser in Steel, require 2 cuts to insure accuracy.

**KEEP CUTTERS SHARP.**

# Patent Involute Cutters

FOR TEETH OF GEAR WHEELS.

FOR USE ON

## No. 6 Automatic Gear Cutting Machines.

Pitch.	Diameter of Cutter.		Hole.	Keyway.	Price per Cutter.	
	Carbon Steel.	HighSp.Steel			Carbon Steel.	HighSp.Steel
1 3-4	6 1-2"	6 1-2"	1 3-4"	3-8 x 3-16"	\$24 00	\$45 00
2	6 1-2	6 1-2	1 3-4	3-8 x 3-16	17 00	42 00
*2 1-4	6 1-4	6 1-2	1 3-4	3-8 x 3-16	13 50	33 60
2 1-2	5 7-8	6 1-8	1 3-4	3-8 x 3-16	11 50	26 00
*2 3-4	5 5-8	5 7-8	1 3-4	3-8 x 3-16	10 50	23 00
3	5 3-8	5 5-8	1 3-4	3-8 x 3-16	9 50	22 00
*3 1-4	5 1-4	5 1-2	1 3-4	3-8 x 3-16	8 50	20 00
*3 1-2	5	5 1-4	1 3-4	3-8 x 3-16	7 75	16 80
*3 3-4	4 3-4	5	1 3-4	3-8 x 3-16	7 50	15 60
4	4 5-8	4 3-4	1 3-4	3-8 x 3-16	7 00	14 40
*4 1-2	4 1-2	4 5-8	1 3-4	3-8 x 3-16	6 50	13 20
5	4 3-8	4 3-8	1 3-4	3-8 x 3-16	6 00	12 00
*5 1-2	4 3-8	4 3-8	1 3-4	3-8 x 3-16	6 00	10 80
6	4 1-4	4 1-4	1 3-4	3-8 x 3-16	5 80	10 40
*7	4 1-8	4 1-8	1 3-4	3-8 x 3-16	5 60	9 10
*8	4	4	1 3-4	3-8 x 3-16	5 40	7 80

Cutters marked \* are not kept in stock but are made to order.

## Cutters for Mitre and Bevel Gears

FOR USE ON

## No. 13 Automatic Gear Cutting Machines.

Pitch.	Diameter of Cutter.		Hole In Cutter.	Keyway.	Price per Cutter.	
	Carbon Steel.	HighSp.Steel			Carbon Steel.	HighSp.Steel
4	3 3-8"	3 1-2"	7-8"	1-8 x 1-16"	\$5 50	\$12 00
5	3 1-8	3 1-4	7-8	1-8 x 1-16	4 75	10 00
6	3	3 1-8	7-8	1-8 x 1-16	4 30	8 00
7	2 3-4	2 7-8	7-8	1-8 x 1-16	4 10	7 00
8	2 3-4	2 7-8	7-8	1-8 x 1-16	3 90	6 00
10	2 5-8	2 5-8	7-8	1-8 x 1-16	3 60	5 30
12	2 1-2	2 1-2	7-8	1-8 x 1-16	3 35	4 70
14	2 3-8	2 3-8	7-8	1-8 x 1-16	2 95	4 15
16	2 3-8	2 3-8	7-8	1-8 x 1-16	2 75	3 85
20	2 1-4	2 1-4	7-8	1-8 x 1-16	2 55	3 65
24	2 1-4	2 1-4	7-8	1-8 x 1-16	2 35	3 45

Eight cutters made for each pitch, page 262. 3 pitch and coarser in Cast Iron and 4 pitch and coarser in Steel, require 2 cuts to insure accuracy.

See pages 267 and 268 for directions for selecting cutters.

**KEEP CUTTERS SHARP.**

## Cutters for Mitre and Bevel Gears.

Diametral Pitch.	Diameter of Cutter.		Hole.	Price per Cutter.	
	Carbon Steel.	High Speed Steel.		Carbon Steel.	High Speed Steel.
3	4"	4"	1 1-4"	\$7 50	\$15 00
4	3 1-2	3 5-8	1 1-4	5 50	12 00
5	3 1-4	3 3-8	1 1-4	4 75	10 00
6	3	3 1-8	1	4 30	8 00
7	2 7-8	2 7-8	1	4 10	7 00
8	2 7-8	2 7-8	1	3 90	6 00
10	2 1-4	2 3-8	7-8	3 50	5 00
12	2 1-8	2 1-4	7-8	3 10	4 25
14	2	2 1-8	7-8	2 70	3 75
16	2	2 1-8	7-8	2 50	3 50
20	1 7-8	2	7-8	2 30	3 30
24	1 3-4	1 3-4	7-8	2 10	3 10

For List of Keyways, see page 242.

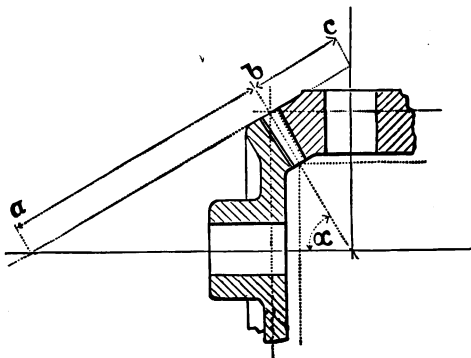
Cutters for pitches not given in the above list will be made to order.

These cutters are thin enough to cut any bevel gear whose tooth face is not longer than one-third the distance from its outer end to the point where the shaft centre lines meet. This makes the tooth thickness at the inner end not less than two-thirds that at the outer end.

In ordering cutters for bevel gears, if the number of teeth in each gear, the pitch and length of face are given, also the angle of the shafts, if different from a right angle, we can select the proper cutter to send.

Eight cutters are made for each pitch and numbered from 1 to 8.

As the number of teeth in the bevel gears to be cut with each cutter will not always agree with the list on page 262, the number of cutter must be found for each pair of gears to be cut according to the following diagram or formula.



$N_a$  = No. of Teeth in Gear.

$N_b$  = No. of Teeth in Pinion.

$\alpha$  = Centre Angle of Gear.

Measure the back cone radius  $a b$  for the gear, or  $b c$  for the pinion. This is equal to the radius of a spur gear, the number of teeth in which would determine the cutter to use. Hence twice  $a b$  times the diametral pitch equals the number of teeth for which the cutter should be selected for the gear. Looking in the list on page 262, the proper number for the cutter can be found.

Thus let the back cone radius  $a b$  be 4" and the diametral pitch be 8. Twice 4 is 8 and  $8 \times 8$  is 64, from which it can be seen that the cutter must be of shape No. 2, as 64 is between 55 and 134, the range covered by a No. 2 cutter.

The number of teeth for which the cutter should be selected can also be found by the following formula:

$$\text{Tan. } \alpha = \frac{N_a}{N_b}$$

$$\text{No. of teeth to select cutter for gear} = \frac{N_a}{\text{Cos. } \alpha}$$

$$\text{No. of teeth to select cutter for pinion} = \frac{N_b}{\text{Sin. } \alpha}$$

If the gears are mitres or are alike, only one cutter is needed; if one gear is larger than the other, two may be needed.

Additional helps on this subject can be found in B & S "Practical Treatise on Gearing," and "Formulas in Gearing."

For List of Publications, see page 195.

# Patent Involute Gear Cutters.

## CIRCULAR PITCH.



We furnish, at short notice, Cutters for cutting the teeth of Gear Wheels according to Circular Pitch, made either from Carbon Steel or High Speed Steel.

Circular Pitch.	Diameter of Cutter.		Hole.	Price per Cutter.	
	Carbon Steel.	High Speed Steel.		Carbon Steel.	High Speed Steel.
1-8"	1 3-4"	1 3-4"	7-8"	\$2 60	\$3 10
3-16	2	2 1-8	7-8	3 00	3 50
1-4	2 1-8	2 1-4	7-8	3 60	4 25
5-16	2 1-4	2 3-8	7-8	4 00	5 00
3-8	2 7-8	2 7-8	1	4 40	6 00
7-16	2 7-8	2 7-8	1	4 60	7 00
1-2	3	3 1-8	1	4 80	8 00
9-16	3 5-8	3 3-4	1 1-4	5 50	9 00
5-8	3 5-8	3 3-4	1 1-4	5 50	10 00
11-16	3 3-4	4	1 1-4	6 00	11 00
3-4	3 7-8	4 1-4	1 1-4	6 50	12 00
13-16	4	4 3-8	1 1-4	7 00	13 00
7-8	4 1-8	4 1-2	1 1-4	7 25	14 00
15-16	4 1-4	4 5-8	1 1-4	7 50	16 00
1	4 3-8	4 3-4	1 1-4	8 50	18 00
1 1-8	5 1-8	5 1-2	1 1-2	10 50	20 00
1 1-4	5 1-2	5 3-4	1 1-2	11 50	23 00
1 3-8	5 3-4	5 3-4	1 1-2	13 50	28 00
1 1-2	5 3-4	5 3-4	1 1-2	16 50	35 00
1 3-4	6 1-2	6 1-2	1 3-4	24 50	45 00
2	7	7	1 3-4	32 50	55 00
2 1-4	7 1-2	7 1-2	1 3-4	35 00	65 00
2 1-2	7 3-4	7 3-4	2	38 50	70 00
2 3-4	8 1-2	8 1-2	2	42 00	80 00
3	8 1-2	8 1-2	2	45 50	85 00

For List of Keyways, see page 242.

# Patent Involute Cutters

FOR TEETH OF GEAR WHEELS.

## CIRCULAR PITCH.

FOR USE ON

### No. 3 Automatic Gear Cutting Machines.

Circular Pitch.	Diameter of Cutter.		Hole.	Keyway.	Price per Cutter.	
	Carbon Steel.	High Speed Steel.			Carbon Steel.	High Speed Steel.
1-8"	2 1-4"	2 1-4"	1"	5-32 x 5-64"	\$2 85	\$3 45
3-16	2 1-2	2 1-2	1	5-32 x 5-64	3 25	3 85
1-4	2 5-8	2 5-8	1	5-32 x 5-64	3 85	4 70
5-16	2 3-4	2 3-4	1	5-32 x 5-64	4 10	5 30
3-8	2 7-8	2 7-8	1	5-32 x 5-64	4 40	6 00
7-16	2 7-8	2 7-8	1	5-32 x 5-64	4 60	7 00
1-2	3	3 1-8	1	5-32 x 5-64	4 80	8 00
9-16	3 1-8	3 1-4	1	5-32 x 5-64	5 00	9 00
5-8	3 1-4	3 3-8	1	5-32 x 5-64	5 25	10 00
11-16	3 3-8	3 1-2	1	5-32 x 5-64	5 50	11 00
3-4	3 1-2	3 5-8	1	5-32 x 5-64	6 00	12 00

FOR USE ON

### Nos. 3H & 4 Automatic Gear Cutting Machines.

Circular Pitch.	Diameter of Cutter.		Hole.	Keyway.	Price per Cutter.	
	Carbon Steel.	High Speed Steel.			Carbon Steel.	High Speed Steel.
3-16"	2 7-8"	2 7-8"	1 1-4"	3-16 x 3-32"	\$3 50	\$4 20
1-4	2 7-8	2 7-8	1 1-4	3-16 x 3-32	4 10	5 10
5-16	3	3	1 1-4	3-16 x 3-32	4 50	6 00
3-8	3 1-4	3 1-4	1 1-4	3-16 x 3-32	4 90	7 30
7-16	3 3-8	3 3-8	1 1-4	3-16 x 3-32	5 10	8 00
1-2	3 1-2	3 1-2	1 1-4	3-16 x 3-32	5 30	8 40
9-16	3 5-8	3 3-4	1 1-4	3-16 x 3-32	5 50	9 00
5-8	3 5-8	3 3-4	1 1-4	3-16 x 3-32	5 50	10 00
11-16	3 3-4	4	1 1-4	3-16 x 3-32	6 00	11 00
3-4	3 7-8	4 1-4	1 1-4	3-16 x 3-32	6 50	12 00
13-16	4	4 3-8	1 1-4	3-16 x 3-32	7 00	13 00
7-8	4 1-8	4 1-2	1 1-4	3-16 x 3-32	7 25	14 00
15-16	4 1-4	4 5-8	1 1-4	3-16 x 3-32	7 50	16 00
1	4 3-8	4 3-4	1 1-4	3-16 x 3-32	8 50	18 00

# Patent Involute Cutters for Teeth of Gear Wheels.

## CIRCULAR PITCH.

FOR USE ON

### No. 5 Automatic Gear Cutting Machines.

Circular Pitch.	Diameter of Cutter.		Hole.	Keyway.	Price per Cutter.	
	Carbon Steel.	High Speed Steel.			Carbon Steel.	High Speed Steel.
5-16"	3 1-2"	3 1-2"	1 1-2"	5-16 x 5-32"	\$5 20	\$6 50
3-8	3 1-2	3 1-2	1 1-2	5-16 x 5-32	5 40	7 50
7-16	3 5-8	3 5-8	1 1-2	5-16 x 5-32	5 60	8 25
1-2	3 3-4	3 7-8	1 1-2	5-16 x 5-32	5 80	9 00
9-16	3 7-8	4 1-8	1 1-2	5-16 x 5-32	6 00	10 00
5-8	4	4 1-4	1 1-2	5-16 x 5-32	6 00	11 00
11-16	4 1-8	4 3-8	1 1-2	5-16 x 5-32	6 50	12 10
3-4	4 1-4	4 1-2	1 1-2	5-16 x 5-32	7 00	13 00
13-16	4 3-8	4 5-8	1 1-2	5-16 x 5-32	7 05	14 30
7-8	4 5-8	4 7-8	1 1-2	5-16 x 5-32	8 00	15 40
15-16	4 3-4	5	1 1-2	5-16 x 5-32	8 50	17 80
1	5	5 1-4	1 1-2	5-16 x 5-32	9 50	19 00
1 1-8	5 1-8	5 1-2	1 1-2	5-16 x 5-32	10 50	20 00
1 1-4	5 1-2	5 3-4	1 1-2	5-16 x 5-32	11 50	23 00
1 3-8	5 3-4	5 3-4	1 1-2	5-16 x 5-32	13 50	28 00
1 1-2	5 3-4	5 3-4	1 1-2	5-16 x 5-32	16 50	35 00

FOR USE ON

### No. 6 Automatic Gear Cutting Machines.

Circular Pitch.	Diameter of Cutter.		Hole.	Keyway.	Price per Cutter.	
	Carbon Steel.	High Speed Steel.			Carbon Steel.	High Speed Steel.
3-8"	4"	4"	1 3-4"	3-8 x 3-16"	\$5 90	\$7 80
7-16	4 1-8	4 1-8	1 3-4	3-8 x 3-16	6 10	9 10
1-2	4 1-4	4 1-4	1 3-4	3-8 x 3-16	6 30	10 40
9-16	4 3-8	4 3-8	1 3-4	3-8 x 3-16	6 50	10 80
5-8	4 3-8	4 3-8	1 3-4	3-8 x 3-16	6 50	12 00
11-16	4 1-2	4 5-8	1 3-4	3-8 x 3-16	7 00	13 20
3-4	4 5-8	4 3-4	1 3-4	3-8 x 3-16	7 50	14 40
13-16	4 3-4	5	1 3-4	3-8 x 3-16	8 00	15 60
7-8	5	5 1-4	1 3-4	3-8 x 3-16	8 25	16 80
15-16	5 1-4	5 1-2	1 3-4	3-8 x 3-16	9 00	20 00
1	5 3-8	5 5-8	1 3-4	3-8 x 3-16	10 00	22 00
1 1-8	5 5-8	5 7-8	1 3-4	3-8 x 3-16	11 00	23 00
1 1-4	5 7-8	6 1-8	1 3-4	3-8 x 3-16	12 00	26 00
1 3-8	6 1-4	6 1-2	1 3-4	3-8 x 3-16	14 00	33 60
1 1-2	6 1-2	6 1-2	1 3-4	3-8 x 3-16	17 50	42 00
1 5-8	6 1-2	6 1-2	1 3-4	3-8 x 3-16	20 00	43 00
1 3-4	6 1-2	6 1-2	1 3-4	3-8 x 3-16	24 50	45 00

# Patent Involute Cutters

FOR TEETH OF GEAR WHEELS.

## Large Diameters.

Pitch.	Diameter of Cutter.		Hole.	Price per Cutter.	
	Carbon Steel.	High Speed Steel.		Carbon Steel.	High Speed Steel.
1	8 1-2"	8 1-2"	1 1-2" or 2"	\$45 00	\$85 00
1 1-4	7 3-4	7 3-4	1 1-2 or 2	38 00	70 00
1 1-2	7 1-4	7 1-4	1 1-2 or 2	33 00	60 00
1 3-4	6 3-4	6 3-4	1 1-2 or 2	25 00	54 00
2	6 1-4	6 1-4	1 1-2 or 2	16 50	38 50
2 1-4	6 1-4	6 1-4	1 1-2 or 2	13 50	30 80
2 1-2	6 1-4	6 1-4	1 1-2 or 2	12 00	26 50
2 3-4	5 3-4	6 1-4	1 1-2 or 2	10 50	25 00
3	5 1-4	5 1-4	1 1-2 or 2	9 50	19 00
4	5 1-4	5 1-4	1 1-2 or 2	8 00	15 85
5	5 1-4	5 1-4	1 1-2 or 2	7 00	14 20
6	4 1-4	4 1-4	1 1-2 or 2	5 80	10 40
7	4 1-4	4 1-4	1 1-2 or 2	5 60	9 10
8	4 1-4	4 1-4	1 1-2 or 2	5 40	8 60
10	4 1-4	4 1-4	1 1-2 or 2	5 20	7 80
12	4 1-4	4 1-4	1 1-2 or 2	4 35	6 65
14	4 1-4	4 1-4	1 1-2 or 2	4 00	6 00
16	4 1-4	4 1-4	1 1-2 or 2	4 00	6 00

For the above Cutters with 1 1-2" hole the Keyways are 3-8" wide and 3-16" deep; with 2" hole the Keyways are 1-2" wide and 3-16" deep.

**KEEP CUTTERS SHARP.**



## Formulas

### For Determining the Dimensions of Gears by Metric Pitch.

Module is the pitch diameter in millimetres divided by the number of teeth in the gear.

Pitch diameter in millimetres is the Module multiplied by the number of teeth in the gear.

$M$  = Module.

$D'$  = The pitch diameter of gear in millimetres.

$D$  = The whole diameter of gear in millimetres.

$N$  = The number of teeth in gear.

$D''$  = The working depth of teeth.

$t$  = Thickness of teeth on pitch line.

$f$  = Amount added to depth for clearance.

Then

$$M = \frac{D'}{N} \text{ or } \frac{D}{N+2}$$

$$D' = N M.$$

$$D = (N+2) M.$$

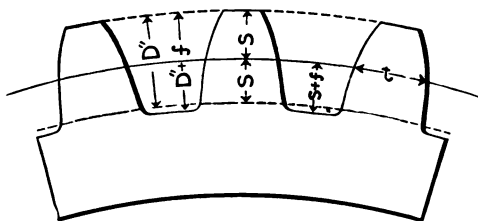
$$N = \frac{D'}{M} \text{ or } \frac{D}{M} - 2$$

$$D'' = 2 M.$$

$$t = M 1.5708.$$

$$f = \frac{M 1.5708}{10} = .157 M.$$

The Module is equal to the part marked "S" in cut, measured in millimetres and parts of millimetres.



## Pitches Commonly Used.

### Module in Millimetres.

Module.	Corresponding English Diametral Pitch.	Module.	Corresponding English Diametral Pitch.
$\frac{1}{2}$ mm.	50.800	5 mm.	5.080
$\frac{3}{4}$	33.867	5.5	4.618
1	25.400	6	4.233
1.25	20.320	7	3.628
1.5	16.933	8	3.175
1.75	14.514	9	2.822
2.	12.700	10	2.540
2.25	11.288	11	2.309
2.5	10.160	12	2.117
2.75	9.236	13	1.954
3	8.466	14	1.814
3.5	7.257	15	1.693
4	6.350	16	1.587
4.5	5.644		

# Patent Metric Involute Cutters

## FOR TEETH OF GEAR WHEELS.

We are prepared to furnish, at short notice, cutters for cutting the teeth of Gear Wheels according to the Metric system.

Module is the Pitch Diameter in millimetres divided by the number of teeth in the gear.

Pitch Diameter in millimetres is the Module multiplied by the number of teeth in the gear.

$M$  = Module.

$N$  = No. of Teeth in Gear.

$D'$  = Pitch Diameter in  $m/m$ .

$D' = M \times N$ .

For example:  $M = 3.50 m/m$ ;  $N = 100$ ;  $D' = 3.50 \times 100 = 350 m/m$ .  
Further explanation, page 273.

Module.	Diameter of Cutter.		Size of Hole.	Price per Cutter.	
	Carbon Steel.	High Speed Steel.		Carbon Steel.	High Speed Steel.
1-2 $m/m$	1 3-4"	1 3-4"	7-8" or 22 $m/m$	\$2 30	\$3 00
3-4	1 3-4	1 3-4	7-8 or 22	2 30	3 00
1	1 3-4	1 3-4	7-8 or 22	2 60	3 10
1 1-4	1 7-8	2	7-8 or 22	2 80	3 30
1 1-2	2	2 1-8	7-8 or 22	3 00	3 50
1 3-4	2	2 1-8	7-8 or 22	3 20	3 75
2	2 1-8	2 1-4	7-8 or 22	3 60	4 25
2 1-4	2 1-4	2 3-8	7-8 or 22	3 80	4 50
2 1-2	2 1-4	2 3-8	7-8 or 22	4 00	5 00
2 3-4	2 3-4	2 3-4	1 or 27	4 20	5 50
3	2 7-8	2 7-8	1 or 27	4 40	6 00
3 1-4	2 7-8	2 7-8	1 or 27	4 40	6 00
3 1-2	2 7-8	2 7-8	1 or 27	4 60	7 00
3 3-4	2 7-8	2 7-8	1 or 27	4 60	7 00
4	3	3 1-8	1 or 27	4 80	8 00
1 1-4	3	3 1-8	1 or 27	4 80	8 00
4 1-2	3 5-8	3 3-4	1 1-4 or 32	5 50	9 00
4 3-4	3 5-8	3 3-4	1 1-4 or 32	5 50	9 00
5	3 5-8	3 3-4	1 1-4 or 32	5 50	10 00
5 1-4	3 5-8	3 3-4	1 1-4 or 32	5 50	10 00
5 1-2	3 3-4	4	1 1-4 or 32	6 00	11 00
5 3-4	3 3-4	4	1 1-4 or 32	6 00	11 00
6	3 7-8	4 1-4	1 1-4 or 32	6 50	12 00
7	4 1-8	4 1-2	1 1-4 or 32	7 25	14 00
8	4 3-8	4 3-4	1 1-4 or 32	8 50	18 00
9	5 1-8	5 1-2	1 1-2 or 40	10 50	20 00
10	5 1-2	5 3-4	1 1-2 or 40	11 50	23 00
11	5 3-4	5 3-4	1 1-2 or 40	13 50	28 00
12	5 3-4	5 3-4	1 1-2 or 40	16 50	35 00

Eight cutters made for each pitch, page 262. List of Keyways, page 242.

**KEEP CUTTERS SHARP.**

# Patent Metric Involute Cutters

FOR TEETH OF GEAR WHEELS.

FOR USE ON

## No. 3 Automatic Gear Cutting Machines.

Module.	Diameter of Cutter.		Size of Hole.	Price per Cutter.	
	Carbon Steel.	High Speed Steel.		Carbon Steel.	High Speed Steel.
3-4 <sup>m</sup> /m	2 1-4"	2 1-4"	1" or 27 <sup>m</sup> /m	\$2 55	\$3 30
1	2 1-4	2 1-4	1 or 27	2 85	3 45
1 1-4	2 3-8	2 3-8	1 or 27	3 05	3 65
1 1-2	2 1-2	2 1-2	1 or 27	3 25	3 85
1 3-4	2 1-2	2 1-2	1 or 27	3 45	4 15
2	2 5-8	2 5-8	1 or 27	3 85	4 70
2 1-4	2 5-8	2 5-8	1 or 27	4 00	4 95
2 1-2	2 3-4	2 3-4	1 or 27	4 10	5 30
3	2 7-8	2 7-8	1 or 27	4 40	6 00
3 1-2	2 7-8	2 7-8	1 or 27	4 60	7 00
4	3	3 1-8	1 or 27	4 80	8 00
4 1-2	3 1-8	3 1-4	1 or 27	5 00	9 00
5	3 1-4	3 3-8	1 or 27	5 25	10 00
5 1-2	3 3-8	3 1-2	1 or 27	5 50	11 00
6	3 1-2	3 5-8	1 or 27	6 00	12 00

FOR USE ON

## Nos. 3H & 4 Automatic Gear Cutting Machines.

Module.	Diameter of Cutter.		Size of Hole.	Price per Cutter.	
	Carbon Steel.	High Speed Steel.		Carbon Steel.	High Speed Steel.
1 1-4 <sup>m</sup> /m	2 3-4"	2 3-4"	1 1-4" or 32 <sup>m</sup> /m	\$3 30	\$4 00
1 1-2	2 7-8	2 7-8	1 1-4 or 32	3 50	4 20
1 3-4	2 7-8	2 7-8	1 1-4 or 32	3 70	4 50
2	2 7-8	2 7-8	1 1-4 or 32	4 10	5 10
2 1-4	2 7-8	2 7-8	1 1-4 or 32	4 30	5 40
2 1-2	3	3	1 1-4 or 32	4 50	6 00
3	3 1-4	3 1-4	1 1-4 or 32	4 90	7 30
3 1-2	3 3-8	3 3-8	1 1-4 or 32	5 10	8 00
4	3 1-2	3 1-2	1 1-4 or 32	5 30	8 40
4 1-2	3 5-8	3 3-4	1 1-4 or 32	5 50	9 00
5	3 5-8	3 3-4	1 1-4 or 32	5 50	10 00
5 1-2	3 3-4	4	1 1-4 or 32	6 00	11 00
6	3 7-8	4 1-4	1 1-4 or 32	6 50	12 00
7	4 1-8	4 1-2	1 1-4 or 32	7 25	14 00
8	4 3-8	4 3-4	1 1-4 or 32	8 50	18 00

Eight cutters made for each pitch. See page 262.

For List of Keyways, see page 242.

**KEEP CUTTERS SHARP.**

# Patent Metric Involute Cutters

FOR TEETH OF GEAR WHEELS.

FOR USE ON

## No. 5 Automatic Gear Cutting Machines.

Module.	Diameter of Cutter.		Size of Hole.	Price per Cutter.	
	Carbon Steel.	High Speed Steel.		Carbon Steel.	High Speed Steel.
2 1-2 m/m	3 1-2"	3 1-2"	1 1-2" or 40 m/m	\$5 20	\$6 50
3	3 1-2	3 1-2	1 1-2 or 40	5 40	7 50
3 1-2	3 5-8	3 5-8	1 1-2 or 40	5 60	8 25
4	3 3-4	3 7-8	1 1-2 or 40	5 80	9 00
4 1-2	3 7-8	4 1-8	1 1-2 or 40	6 00	10 00
5	4	4 1-4	1 1-2 or 40	6 00	11 00
5 1-2	4 1-8	4 3-8	1 1-2 or 40	6 50	12 10
6	4 1-4	4 1-2	1 1-2 or 40	7 00	13 20
7	4 5-8	4 7-8	1 1-2 or 40	8 00	15 40
8	5	5 1-4	1 1-2 or 40	9 50	19 00
9	5 1-8	5 1-2	1 1-2 or 40	10 50	20 00
10	5 1-2	5 3-4	1 1-2 or 40	11 50	23 00
11	5 3-4	5 3-4	1 1-2, or 40	13 50	28 00
12	5 3-4	5 3-4	1 1-2 or 40	16 50	35 00

FOR USE ON

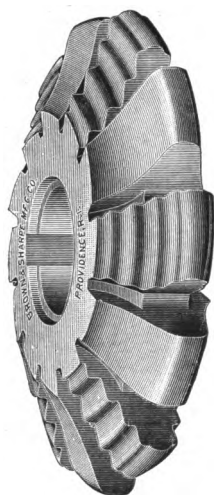
## No. 6 Automatic Gear Cutting Machines.

Module.	Diameter of Cutter.		Size of Hole.	Price per Cutter.	
	Carbon Steel.	High Speed Steel.		Carbon Steel.	High Speed Steel.
3 m/m	4"	4"	1 3-4" or 45 m/m	\$5 90	\$7 80
3 1-2	4 1-8	4 1-8	1 3-4 or 45	6 10	9 10
4	4 1-4	4 1-4	1 3-4 or 45	6 30	10 40
4 1-2	4 3-8	4 3-8	1 3-4 or 45	6 50	10 80
5	4 3-8	4 3-8	1 3-4 or 45	6 50	12 00
5 1-2	4 1-2	4 5-8	1 3-4 or 45	7 00	13 20
6	4 5-8	4 3-4	1 3-4 or 45	7 50	14 40
7	5	5 1-4	1 3-4 or 45	8 25	16 80
8	5 3-8	5 5-8	1 3-4 or 45	10 00	22 00
9	5 5-8	5 7-8	1 3-4 or 45	11 00	23 00
10	5 7-8	6 1-8	1 3-4 or 45	12 00	26 00
11	6 1-4	6 1-2	1 3-4 or 45	14 00	33 60
12	6 1-2	6 1-2	1 3-4 or 45	17 50	42 00

Eight cutters made for each pitch, see page 262.

For List of Keyways, see page 242.

**KEEP CUTTERS SHARP.**



## Improved Stocking Cutters for Involute Gears.

By the use of these cutters, heavy cuts at fast speeds and coarse feeds can be taken because of the easier cutting action produced.

The greater part of the cutting is performed by the plain teeth, the stepped teeth projecting beyond the outline of the plain teeth only enough to break up the chips.

Because of the smooth and easy cutting action a minimum amount of power is consumed in driving the machine.

Diametral Pitch.	Diameter of Cutter.		Size of Hole in Cutter.	Price per Cutter.	
	Carbon Steel.	High Speed Steel.		Carbon Steel.	High Speed Steel.
*1	8 1-2"	8 1-2"	2"	\$45 00	\$85 00
*1 1-4	7 3-4	7 3-4	2	38 00	70 00
*1 1-2	7	7	1 3-4	32 00	55 00
1 3-4	6 1-2	6 1-2	1 3-4	24 00	45 00
2	5 3-4	5 3-4	1 1-2	16 00	35 00
*2 1-4	5 3-4	5 3-4	1 1-2	13 00	28 00
2 1-2	5 1-2	5 3-4	1 1-2	11 00	23 00
*2 3-4	5 1-8	5 1-2	1 1-2	10 00	20 00
3	4 3-8	4 3-4	1 1-4	8 00	18 00
*3 1-4	4 1-4	4 5-8	1 1-4	7 00	16 00
*3 1-2	4 1-8	4 1-2	1 1-4	6 75	14 00
*3 3-4	4	4 3-8	1 1-4	6 50	13 00
4	3 7-8	4 1-4	1 1-4	6 00	12 00
*4 1-2	3 3-4	4	1 1-4	5 50	11 00
5	3 5-8	3 3-4	1 1-4	5 00	10 00
*5 1-2	3 5-8	3 3-4	1 1-4	5 00	9 00
6	3	3 1-8	1	4 30	8 00
7	2 7-8	2 7-8	1	4 10	7 00
8	2 7-8	2 7-8	1	3 90	6 00

Cutters marked \* are not kept in stock but are made to order.

List continued on next page.

For List of Keyways, see page 242.

# Improved Stocking Cutters

FOR USE ON

## No. 3 Automatic Gear Cutting Machines.

Diametral Pitch.	Diameter of Cutter.		Hole.	Keyway.	Price per Cutter.	
	Carbon Steel.	High Speed Steel.			Carbon Steel.	High Speed Steel.
4	3 1-2"	3 5-8"	1"	5-32 x 5-64"	\$5 50	\$12 00
*4 1-2	3 3-8	3 1-2	1	5-32 x 5-64	5 00	11 00
5	3 1-4	3 3-8	1	5-32 x 5-64	4 75	10 00
*5 1-2	3 1-8	3 1-4	1	5-32 x 5-64	4 50	9 00
6	3	3 1-8	1	5-32 x 5-64	4 30	8 00
7	2 7-8	2 7-8	1	5-32 x 5-64	4 10	7 00
8	2 7-8	2 7-8	1	5-32 x 5-64	3 90	6 00

FOR USE ON

## Nos. 3H & 4 Automatic Gear Cutting Machines.

Diametral Pitch.	Diameter of Cutter.		Hole.	Keyway.	Price per Cutter.	
	Carbon Steel.	High Speed Steel.			Carbon Steel.	High Speed Steel.
3	4 3-8"	4 3-4"	1 1-4"	3-16 x 3-32"	\$8 00	\$18 00
*3 1-2	4 1-8	4 1-2	1 1-4	3-16 x 3-32	6 75	14 00
4	3 7-8	4 1-4	1 1-4	3-16 x 3-32	6 00	12 00
*4 1-2	3 3-4	4	1 1-4	3-16 x 3-32	5 50	11 00
5	3 5-8	3 3-4	1 1-4	3-16 x 3-32	5 00	10 00
*5 1-2	3 5-8	3 3-4	1 1-4	3-16 x 3-32	5 00	9 00
6	3 1-2	3 1-2	1 1-4	3-16 x 3-32	4 80	8 40
7	3 3-8	3 3-8	1 1-4	3-16 x 3-32	4 60	8 00
8	3 1-4	3 1-4	1 1-4	3-16 x 3-32	4 40	7 30

Cutters marked \* are not kept in stock, but are made to order.

# Improved Stocking Cutters

FOR USE ON

## No. 5 Automatic Gear Cutting Machines.

Diametral Pitch.	Diameter of Cutter.		Size of Hole in Cutter.	Keyway.	Price per Cutter.	
	Carbon Steel.	High Speed Steel.			Carbon Steel.	High Speed Steel.
2	5 3-4"	5 3-4"	1 1-2"	5-16 x 5-32"	\$16 00	\$35 00
*2 1-4	5 3-4	5 3-4	1 1-2	5-16 x 5-32	13 00	28 00
2 1-2	5 1-2	5 3-4	1 1-2	5-16 x 5-32	11 00	23 00
*2 3-4	5 1-8	5 1-2	1 1-2	5-16 x 5-32	10 00	20 00
3	5	5 1-4	1 1-2	5-16 x 5-32	9 00	19 00
*3 1-4	4 3-4	5	1 1-2	5-16 x 5-32	8 00	17 80
*3 1-2	4 5-8	4 7-8	1 1-2	5-16 x 5-32	7 50	15 40
*3 3-4	4 3-8	4 5-8	1 1-2	5-16 x 5-32	7 00	14 30
4	4 1-4	4 1-2	1 1-2	5-16 x 5-32	6 50	13 20
*4 1-2	4 1-8	4 3-8	1 1-2	5-16 x 5-32	6 00	12 10
5	4	4 1-4	1 1-2	5-16 x 5-32	5 50	11 00
*5 1-2	3 7-8	4 1-8	1 1-2	5-16 x 5-32	5 50	10 00
6	3 3-4	3 7-8	1 1-2	5-16 x 5-32	5 30	9 00
7	3 5-8	3 5-8	1 1-2	5-16 x 5-32	5 10	8 25
8	3 1-2	3 1-2	1 1-2	5-16 x 5-32	4 90	7 50

FOR USE ON

## No. 6 Automatic Gear Cutting Machines.

Diametral Pitch.	Diameter of Cutter.		Size of Hole in Cutter.	Keyway.	Price per Cutter.	
	Carbon Steel.	High Speed Steel.			Carbon Steel.	High Speed Steel.
1 3-4	6 1-2"	6 1-2"	1 3-4"	3-8 x 3-16"	\$24 00	\$45 00
2	6 1-2	6 1-2	1 3-4	3-8 x 3-16	17 00	42 00
*2 1-4	6 1-4	6 1-2	1 3-4	3-8 x 3-16	13 50	33 60
2 1-2	5 7-8	6 1-8	1 3-4	3-8 x 3-16	11 50	26 00
*2 3-4	5 5-8	5 7-8	1 3-4	3-8 x 3-16	10 50	23 00
3	5 3-8	5 5-8	1 3-4	3-8 x 3-16	9 50	22 00
*3 1-4	5 1-4	5 1-2	1 3-4	3-8 x 3-16	8 50	20 00
*3 1-2	5	5 1-4	1 3-4	3-8 x 3-16	7 75	16 80
*3 3-4	4 3-4	5	1 3-4	3-8 x 3-16	7 50	15 60
4	4 5-8	4 3-4	1 3-4	3-8 x 3-16	7 00	14 40
*4 1-2	4 1-2	4 5-8	1 3-4	3-8 x 3-16	6 50	13 20
5	4 3-8	4 3-8	1 3-4	3-8 x 3-16	6 00	12 00
*5 1-2	4 3-8	4 3-8	1 3-4	3-8 x 3-16	6 00	10 80
6	4 1-4	4 1-4	1 3-4	3-8 x 3-16	5 80	10 40
*7	4 1-8	4 1-8	1 3-4	3-8 x 3-16	5 60	9 10
*8	4	4	1 3-4	3-8 x 2-16	5 40	7 80

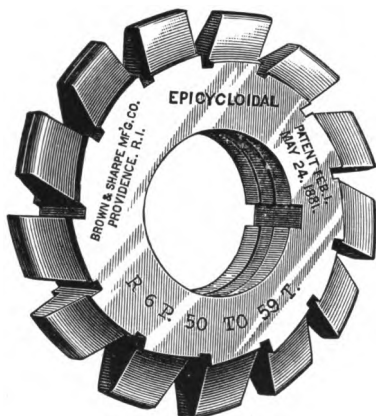
Cutters marked \* are not kept in stock, but are made to order.



# Patent Epicycloidal Cutters

FOR TEETH OF GEAR WHEELS.

**Which can be Sharpened by Grinding without  
Changing their Form.**



We furnish cutters of epicycloidal form, which are sharpened upon the face the same as the involute cutters. As gears of this form of teeth to run well must be cut accurately to the proper depth that the pitch lines may coincide, we make the cutters with a shoulder (see cut above) which determines the exact depth that the tooth should be cut. Care taken in sizing the blanks obviates the necessity of any measurements in cutting the teeth. The cutters are made for either diametral or circular pitches and the same rules apply in finding the diameters of blanks as in our system of involute teeth, *i. e.*, 2 pitches added to the diameter at pitch line. See formulas, pages 294 to 296, and tables showing corresponding circular and diametral pitches, page 285.

These cutters will cut gears that will interchange.

The white line on edge of the two left hand upper teeth of cut represents a centre line on the cutter teeth, which may be a convenience in setting the cutter central.

The cutters are marked with letters from A to X, by which they may be ordered. See following table for dimensions of cutters, and page 261 for directions, etc.

# Patent Epicycloidal Cutters

## For Teeth of Gear Wheels.

All Gears of same Pitch cut with these Cutters are interchangeable.

Diametral Pitch.	Diameter of Cutter.	Size of Hole in Cutter.	Price per Cutter, Carbon Steel.
*2	5"	1 1-4"	\$15 50
*2 1-4	4 1-2	1 1-4	14 00
*2 1-2	4 1-4	1 1-4	13 00
*2 3-4	4	1 1-4	11 75
3	3 13-16	1 1-4	10 75
*3 1-2	3 9-16	1 1-4	9 75
4	3 3-8	1 1-4	6 60
5	3 1-16	1 1-4	5 65
6	2 3-4	1 1-16	4 65
*7	2 9-16	1 1-16	4 40
8	2 1-2	1 1-16	3 90
*9	2 3-8	1 1-16	3 65
10	2 1-8	7-8	3 40
*12	2	7-8	3 20
*14	2	7-8	3 00
*16	1 15-16	7-8	2 80

Cutters marked \* are not kept in stock, but are made to order.

For List of Keyways, see page 242.

## Cutters are Marked with Letters.

### 24 Cutters in Each Set.

Cutter	A	cuts	12 teeth.	Cutter	M	cuts	27 to 29 teeth.
"	B	"	13 "	"	N	"	30 " 33 "
"	C	"	14 "	"	O	"	34 " 37 "
"	D	"	15 "	"	P	"	38 " 42 "
"	E	"	16 "	"	Q	"	43 " 49 "
"	F	"	17 "	"	R	"	50 " 59 "
"	G	"	18 "	"	S	"	60 " 74 "
"	H	"	19 "	"	T	"	75 " 99 "
"	I	"	20 "	"	U	"	100 " 149 "
"	J	"	21 to 22 "	"	V	"	150 " 249 "
"	K	"	23 " 24 "	"	W	"	250 or more.
"	L	"	25 " 26 "	"	X	"	Rack.

In ordering, give the Letter on Cutter and the Pitch required.

## The Sizing and Cutting of Gear Wheels.

**Diameter**, when applied to gears, is always understood to mean the pitch diameter.

**Diametral Pitch** is the number of teeth to each inch of the pitch diameter.

**EXAMPLE.** If a gear has 40 teeth and the pitch diameter is 4 inches, there are 10 teeth to each inch of the pitch diameter and the diametral pitch is 10, or, in other words, the gear is 10 diametral pitch.

**Diametral Pitch** required, circular pitch given. Divide 3.1416 by the circular pitch.

**EXAMPLE.** If the circular pitch is 2 inches, divide 3.1416 by 2 and the quotient, 1.5708, is the diametral pitch.

**Diametral Pitch** required, number of teeth and outside diameter given. Add 2 to the number of teeth and divide by the outside diameter.

**EXAMPLE.** If the number of teeth is 40, the diameter of the blank is 10 1-2 inches; add 2 to the number of teeth, making 42, and divide by 10 1-2; the quotient, 4, is the diametral pitch.

**Circular Pitch** is the distance from the centre of one tooth to the centre of the next, measured along the pitch line.

**EXAMPLE.** If the distance from the centre of one tooth to the centre of next tooth, measured along the pitch circle, is 1-2 inch, the gear is 1-2 inch circular pitch.

**Circular Pitch** required, diametral pitch given. Divide 3.1416 by the diametral pitch.

**EXAMPLE.** If the diametral pitch is 4, divide 3.1416 by 4 and the quotient, .7854 inch, is the circular pitch.

**Number of Teeth** required, pitch diameter and diametral pitch given. Multiply the pitch diameter by the diametral pitch.

**EXAMPLE.** If the diameter of the pitch circle is 10 inches and the diametral pitch is 4, multiply 10 by 4 and the product, 40, will be the number of teeth in the gear.

**Number of Teeth** required, outside diameter and diametral pitch given. Multiply the outside diameter by the diametral pitch and subtract 2.

**EXAMPLE.** If the whole diameter is 10 1-2 and the diametral pitch is 4, multiply 10 1-2 by 4 and the product, 42, less 2, or 40, is the number of teeth.

**Pitch Diameter** required, number of teeth and diametral pitch given. Divide the number of teeth by the diametral pitch.

**EXAMPLE.** If the number of teeth is 40 and the diametral pitch is 4, divide 40 by 4 and the quotient, 10, is the pitch diameter.

**Outside Diameter** or size of gear blank required, number of teeth and diametral pitch given. Add 2 to the number of teeth and divide by the diametral pitch.

**EXAMPLE.** If the number of teeth is 40 and the diametral pitch is 4, add 2 to the 40, making 42, and divide by 4; the quotient, 10 1-2, is the whole diameter of the gear or blank.

**Thickness of Tooth at Pitch Line** required. Divide the circular pitch by 2, or 1.57 by the diametral pitch.

**EXAMPLE.** If the circular pitch is 1.047 inch, or the diametral pitch is 3, divide 1.047 by 2, or 1.57 by 3, and the quotient, .523 inch, is the thickness of tooth.

**Whole Depth of Tooth** required. Divide 2.157 by the diametral pitch.

**EXAMPLE.** If the diametral pitch of a gear is 6, the whole depth is 2.157 divided by 6, which equals .3595.

**Whole Depth of Tooth** is about 11-16 or exactly .6866 of the circular pitch.

**EXAMPLE.** If the circular pitch is 2, the whole depth of tooth is about 11-16 of 2 inches or 1 3-8 inches nearly.

**Distance between Centres** of two gears required. Add the number of teeth together and divide one half the sum by the diametral pitch.

**EXAMPLE.** If two gears have 50 and 30 teeth, respectively, and are 5 pitch, add 50 and 30, making 80, divide by 2, and then divide the quotient, 40, by the diametral pitch, 5, and the result, 8 inches, is the centre distance.

**To Facilitate the Measurement** of wheels to be sized according to diametral pitch, either of the following steel rules described can be used: No. 377, Style 1, is a 12-inch rule containing four lines of graduations upon each side, one each as follows: 18ths, 20ths, 22ds, 24ths, 26ths, 28ths, 30ths and 32nds. Each line of graduations is figured the whole length of the rule, 10, 20, 30, etc. Suppose a wheel of 60 teeth of 20 pitch is to be sized, then find 60 on the line of 20ths and that is the pitch diameter of the required wheel; then add two of the divisions to make the outside diameter, which is sixty-two twentieths. No. 377, Style 2, is also a 12-inch rule having one inch only of graduations on each end as follows: 6ths, 7ths, 8ths, 9ths, 10ths, 11ths, 12ths, 14ths, 16ths, 18ths, 20ths, 22ds, 24ths, 26ths, 28ths, 30ths, 32ds, 34ths, 36ths, 38ths. The intermediate ten inches are blank, except that the inch lines are made clear across the rule. Suppose a wheel of 83 teeth of 10 pitch is to be sized, then take eight of the blank inches and three of the 10th graduations and that gives the pitch diameter of the required wheel, add two of the tenths which gives the outside diameter which is eight and five-tenths inches. These rules furnish graduations for a large variety of pitches and are the best adapted for the use for which they are designed. For prices of these rules, see page 72.

In addition to the foregoing are made 12 and 24 inch rules with No. 5 graduation, as follows:

1st corner, 11, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25.

2nd corner, 16, 32, 64.

3rd corner, 26, 27, 28, 29, 30, 31, 33, 34, 35, 36, 37, 38.

4th corner, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 100.

On pages 294 to 296, formulas and examples are given for all calculations required in connection with size and pitch of wheels.

No. 1 Table shows the diametral pitches with the corresponding circular pitches.

No. 2 Table shows the circular pitches with the corresponding diametral pitches.

TABLE No. 1.

Diametral Pitch.	Circular Pitch.	Diametral Pitch.	Circular Pitch.
1 1-4	2.5133"	11	.286
1 1-2	2.0944	12	.262
1 3-4	1.7952	14	.224
2	1.571	16	.196
2 1-4	1.396	18	.175
2 1-2	1.257	20	.157
2 3-4	1.142	22	.143
3	1.047	24	.131
3 1-2	.898	26	.121
4	.785	28	.112
5	.628	30	.105
6	.524	32	.098
7	.449	36	.087
8	.393	40	.079
9	.349	48	.065
10	.314		

TABLE No. 2.

Circular Pitch.	Diametral Pitch.	Circular Pitch.	Diametral Pitch.
2"	1.571	3-4	4.189
1 7-8	1.676	11-16	4.570
1 3-4	1.795	5-8	5.027
1 5-8	1.933	9-16	5.585
1 1-2	2.094	1-2	6.283
1 7-16	2.185	7-16	7.181
1 3-8	2.285	3-8	8.378
1 5-16	2.394	5-16	10.053
1 1-4	2.513	1-4	12.566
1 3-16	2.646	3-16	16.755
1 1-8	2.793	1-8	25.133
1 1-16	2.957	1-16	50.266
1	3.142		
15-16	3.351		
7-8	3.590		
13-16	3.867		

According to the system adopted by the Brown & Sharpe Mfg. Co., any wheel of one pitch will gear into any other wheel or into a rack of the same pitch. Eight cutters are required for each pitch. These eight cutters are adapted to cut from a pinion of twelve teeth to a rack, and are numbered respectively, 1, 2, 3, &c. The number of teeth and the pitch for which a cutter is adapted is also marked on each.

No. 1 will cut wheels from 135 teeth to a rack.

" 2	"	"	"	"	55	"	"	134 teeth.
" 3	"	"	"	"	35	"	"	54 "
" 4	"	"	"	"	26	"	"	34 "
" 5	"	"	"	"	21	"	"	25 "
" 6	"	"	"	"	17	"	"	20 "
" 7	"	"	"	"	14	"	"	16 "
" 8	"	"	"	"	12	"	"	13 "

If a cutter is wanted for a wheel of 40 teeth of 8 pitch, then the cutter required would be No. 3 of 8 pitch, inasmuch as a No. 3 cutter will cut all wheels containing from 35 to 54 teeth inclusive, and 40 occurring between those numbers, that is the one desired. It should be borne in mind that eight different cutters are required in order to cut all the wheels of any given pitch. Directions for the use of these cutters will be found upon pages 260 and 261.

As these cutters allow of being ground when dull, it is important that they be kept sharp. By paying particular attention to this, cutting will be greatly facilitated, beside being much better done.

It is desirable in applying gearing of any kind, to avoid having wheels or pinions with a small number of teeth. Pinions of twelve teeth will work very well, but a less number of teeth should not be used.

Few mechanics are familiar with the minutiae of gearing and the necessity of exact sizing of wheels, as to diameter, is often overlooked. Special care is required also to know that the distance of the centres of two wheels running together is correct relatively to the diameters.

**TABLE showing Depth of Space and Thickness of Tooth in Spur Wheels,  
when cut with our Patent Cutters.**

Pitch of Cutter.	Depth to be cut in Gear.	Thickness of Tooth at Pitch Line.	Pitch of Cutter.	Depth to be cut in Gear.	Thickness of Tooth at Pitch Line.
1 1-4	1.726"	1.257"	11	.196"	.143"
1 1-2	1.438	1.047	12	.180	.131
1 3-4	1.233	.898	14	.154	.112
2	1.079	.785	16	.135	.098
2 1-4	.959	.698	18	.120	.087
2 1-2	.863	.628	20	.108	.079
2 3-4	.784	.571	22	.098	.071
3	.719	.524	24	.090	.065
3 1-2	.616	.449	26	.083	.060
4	.539	.393	28	.077	.056
5	.431	.314	30	.072	.052
6	.360	.262	32	.067	.049
7	.308	.224	36	.060	.044
8	.270	.196	40	.054	.039
9	.240	.175	48	.045	.033
10	.216	.157			

## Tooth Flanks Undercut.

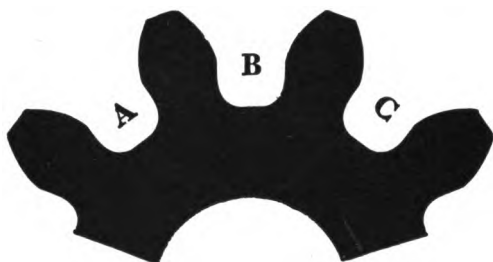


Fig. 1.



Fig. 2.

It is well known that involute gears can be made of different systems or of different angles of obliquity or pressure. In the system proposed by Professor Willis in 1838, which we adopted in 1864, the angle of pressure, or obliquity, is  $14\ 1-2^\circ$ . Twice this angle is the familiar angle of the worm thread tool gauge in common use. Gears made upon this system are thought to crowd less upon their shafts than those having a greater angle of pressure. If, however, a gear or pinion has less than 12 teeth, this angle may cause their flanks to be undercut and in consequence weak, in order to clear the faces of an engaging gear. The cut of a segment of a gear of 10 teeth, 4 diametral pitch, Fig. 1, illustrates this under cutting, which is greater as the teeth are less.

Gears or pinions having less than 12 teeth might be unavailable if undercut as much as at A, B and C, in the illustration, Fig. 1. Hence, gears that are to do heavy work may require a greater angle of pressure than  $14\ 1-2^\circ$ , if they are to run with a pinion of less than 12 teeth. If a different angle is required, special cutters will have to be made at an extra cost.

In the choice of an angle of pressure, some help may be obtained from Fig. 2, which is taken from a gear 10 teeth, 4 pitch. The angle of pressure in these teeth is  $22\ 1-2^\circ$ . The greater strength of the tooth flanks in this figure is readily seen. The angle cannot be much more than  $32^\circ$  and have the addendum of the teeth of the ordinary height, which is equal to the module.

# Comparative Sizes of Gear Teeth.

INVOLUTE.



20 P



18 P



16 P



14 P



12 P



10 P



9 P



8 P



7 P



6 P



5 P



4 P



# Comparative Sizes of Gear Teeth.

INVOLUTE—(Continued).



**3 P**



**2½ P**



**2 P**

## Worm Hobs.

### WITH RELIEVED TEETH



We are prepared by the use of special machinery to make Worm or Spur Gear Hobs, the teeth of which can be ground on their faces without changing their form.

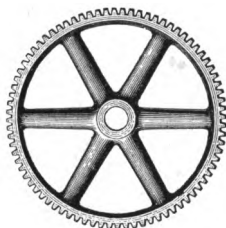
By our method of relieving hobs, they cut as freely as milling cutters and are sharpened in the same manner as our formed cutters.

We usually make the hobs a sufficient amount larger than the worm to give clearance to the top of the teeth and to allow a reasonable amount for the grinding of the teeth without reducing the diameter of the hob to less than that of the worm.

**Ordering Hobs.** In ordering hobs the following data should be given: The outside diameter and length of the worm, the lead, i. e., the advance to one turn, whether the thread is single, double, etc., right or left hand, diameter of hole, size of keyway, material to be cut, whether hob is to be made of carbon or high speed steel, the method of cutting the worm, whether in a lathe with a tool or in a milling machine with a cutter and if so give the size of the cutter. It is also advisable to give the included angle of the tool or cutter to be used in cutting the worm, also state the number of teeth in the wheel and whether it is driven by the hob when hobbing or by the hobbing machine spindle.

If the nature of the work requires a hob of exact diameter, it should be plainly stated when ordering, otherwise the allowance mentioned above will be added.

## Standard Gears.



An experience of many years in making and cutting Gear Wheels to order, the dimensions of which, in those of the same pitch, have been so varied in width and thickness of rims, arms, etc., made us realize the great advantages which would result from a uniform standard of sizes. We have therefore made iron patterns uniform in style and are now prepared, by the aid of automatic machinery, to furnish gears as follows, singly or in quantities to suit, at reasonable prices:

Planed Bevel or Mitre Gears.

Spiral Gears to 36" diameter.

Angular and Circular Bevel Gears to 18" diameter.

Spur Gears to 72" diameter.

We are also prepared to cut Worms and hob Worm Gears for all purposes.

We carry a full line of Standard Cast Iron Gears in stock and, for the convenience of our customers, the following agents also carry a full line in stock:

CAREY MACHINERY AND SUPPLY CO., 119-121 E. Lombard Street, Baltimore, Md.

PATTERSON, GOTTFRIED & HUNTER, INC., 211-215 Centre Street and 147-151 Lafayette Street, New York, N. Y.

CHANDLER & FARQUHAR, 34-38 Federal Street and 419-425 Atlantic Ave., Boston, Mass.

CHAS. H. BESLY & CO., 118-124 North Clinton Street, Chicago, Ill.

THE CHARLES A. STRELINGER CO., 96-110 Bates St., cor. Congress, Detroit, Mich.

Gear List mailed to any address upon application.

## Bevel Gears.

The curve of teeth in bevel gears, when correctly formed, changes constantly from one end of the tooth to the other. Therefore bevel gears, whose teeth are produced with a cutter of fixed curve, are not theoretically correct, the cutter usually being of a curve that will make the correct form at the outer part of the face of the gear, and of necessity will leave the curves too large at the inside ends of the teeth.

Small bevel gearing is almost universally produced in this manner, which practically answers the purpose, except when the teeth are very coarse or the gears very small, in which cases their operation is not satisfactory.

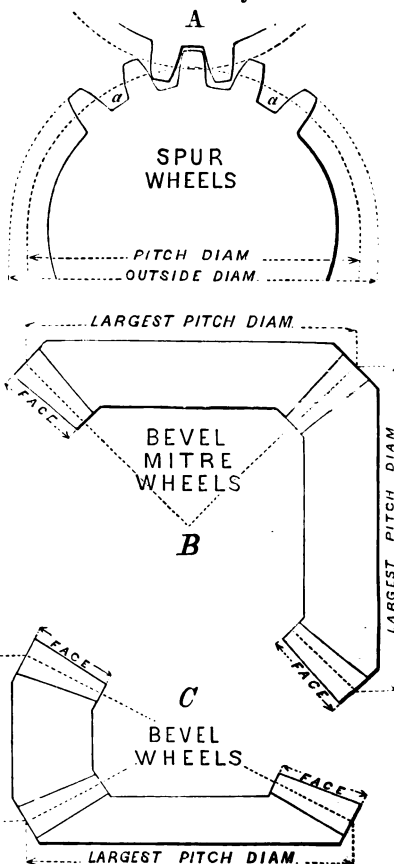
In place of cutting by changing position of cutter, etc., the teeth are often filed slightly, in order to round them off to the curve required for their free running.

On all bevel gears cut with a cutter of fixed curve, it is necessary to cut through twice owing to the necessity of making the thickness of the cutter on the pitch line equal to about .005" thinner than the space between the teeth at the smallest pitch diameter. As the width of space between the teeth on the largest pitch diameter should be greater than the thickness of the cutter, it must be made so by passing the cutter through the second time.

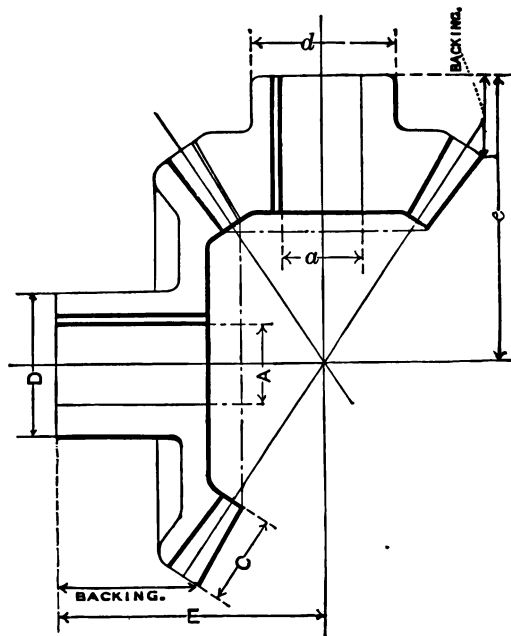
The cuts on this page will explain the forms of spur, bevel and mitre gears, also the terms "pitch diameter," "outside diameter," "largest pitch diameter," "length of face," etc.

When a pair of bevel gears are of same size and number of teeth, with their lines of centres at right angles, they are called "mitre gears," and one cutter will answer for both; but where one gear has a greater number of teeth, or differs in bevel from the one running into it, then each of the pair of gears may require a different cutter.

For directions in ordering cutters for bevel gears, see pages 267 and 268.



# Instructions for Ordering Bevel Gears.



When ordering Bevel Gears please give the following information:

Pitch, or if preferred, give diameter of pitch circle.

Number of teeth in gear.

Number of teeth in pinion.

Diameter of Hole in gear, A.

Diameter of Hole in pinion, a.

Backing for both gear and pinion.

Width of face, C.

Diameter of gear hub, D.

Diameter of pinion hub, d, if these dimensions are of importance.

Distance from centre of pinion shaft to end of gear hub, E.

Distance from centre of gear shaft to end of pinion hub, e.

Keyway or set screw, and what size?

Material to be used.

To be used for pattern or not?

Does the pinion drive or is it driven?

Unless otherwise specified, face and ends of hubs only will be finished and stock will be left on ends of hub for fitting.

# Formulas

## For Determining the Dimensions of Gears by Diametral Pitch.

Let  $P$  denote the diametral pitch, or the number of teeth to one inch of diameter of pitch circle.

"	D'	"	"	diameter of pitch circle.	}	Larger	}	These wheels run together		
"	D	"	"	whole diameter.						
"	D'''	"	"	bottom diameter.						
"	N	"	"	number of teeth.						
"	V	"	"	velocity.	}	Smaller			}	These wheels run together
"	d'	"	"	diameter of circle.						
"	d	"	"	whole diameter.						
"	d'''	"	"	bottom diameter.						
"	n	"	"	number of teeth.	}	Wheel.	}	These wheels run together		
"	v	"	"	velocity.						
"	a	"	"	distance between the centres of the two wheels.						
"	b	"	"	number of teeth in both wheels.						
"	t	"	"	thickness of tooth or cutter on pitch circle.	}	Wheel.			}	These wheels run together
"	D"	"	"	working depth of tooth.						
"	f	"	"	amount added to depth of tooth for rounding the corners and for clearance.						
"	D" + f	denote the whole depth of tooth.								
"	$\pi$	denote the constant 3.1416.								
"	P'	denote the circular pitch or the distance from the centre of one tooth to the centre of the next on the pitch circle.								

The examples placed opposite the formulas on the two pages following are for a single wheel of 12 pitch, 6.166 in. or 6 2-12 in. diameter, etc., and in the case of the two wheels the larger has the same dimensions. The velocities are respectively 1 and 2.

## For a Single Wheel.

FORMULAS.

EXAMPLES.

$$P = \frac{N+2}{D} = \frac{72+2}{6.166}, \text{ or } \frac{72+2}{6 \ 2-12} = 12 \quad 1$$

$$P = \frac{N}{D'} = \frac{72}{6} = 12 \quad 2$$

$$D' = \frac{D \times N}{N+2} = \frac{6.166 \times 72}{72+2} = 6 \quad 3$$

$$D' = \frac{N}{P} = \frac{72}{12} = 6 \quad 4$$

$$N = P D' = 12 \times 6 = 72 \quad 5$$

$$N = P D - 2 = 12 \times 6.166 - 2, \text{ or } 12 \times 6 \ 2-12 - 2 = 72 \quad 6$$

$$D = \frac{N+2}{P} = \frac{72+2}{12} = 6.166, \text{ or } 6 \ 2-12 \quad 7$$

$$D = D' + \frac{2}{P} = 6 + \frac{2}{12}, \text{ or } 6 + .166 = 6.166 \quad 8$$

$$D''' = \frac{N-2.314}{P} = \frac{72-2.314}{12} = 5.807 \quad 9$$

$$D''' = D - 2 (D'' + f) = 6.166 - .3596 = 5.807 \quad 10$$

$$t = \frac{1.57}{P} = \frac{1.57}{12} = .130 \quad 11$$

$$D'' = \frac{2}{P} = \frac{2}{12} = .166, \text{ or } 2-12 \quad 12$$

$$f = \frac{t}{10} = \frac{.130}{10} = .013 \quad 13$$

$$D'' + f = .166 + .013 = .179 \quad 14$$

$$P' = \frac{\pi}{P} = \frac{3.1416}{12} = .262 \quad 15$$

$$P = \frac{\pi}{P'} = \frac{3.1416}{.262} = 12 \quad 16$$

## For a Pair of Wheels.

FORMULAS.

EXAMPLES.

$$b = 2 a P = 2 \times 4.5 \times 12 = 108 \dots\dots\dots 17$$

$$n = \frac{b V}{v + V} = \frac{108 \times 1}{3} = 36 \dots\dots\dots 18$$

$$N = \frac{n v}{V} = \frac{36 \times 2}{1} = 72 \dots\dots\dots 19$$

$$n = \frac{N V}{v} = \frac{72 \times 1}{2} = 36 \dots\dots\dots 20$$

$$N = \frac{b v}{v + V} = \frac{108 \times 2}{3} = 72 \dots\dots\dots 21$$

$$n = \frac{P D' V}{v} = \frac{12 \times 6 \times 1}{2} = 36 \dots\dots\dots 22$$

$$V = \frac{n v}{N} = \frac{36 \times 2}{72} = 1 \dots\dots\dots 23$$

$$v = \frac{N V}{n} = \frac{72 \times 1}{36} = 2 \dots\dots\dots 24$$

$$v = \frac{P D' V}{n} = \frac{12 \times 6 \times 1}{36} = 2 \dots\dots\dots 25$$

$$D = \frac{2 a (N + 2)}{b} = \frac{2 \times 4.5 \times (72 + 2)}{108} = 6.166 \dots\dots\dots 26$$

$$d = \frac{2 a (n + 2)}{b} = \frac{2 \times 4.5 \times (36 + 2)}{108} = 3.166 \dots\dots\dots 27$$

$$a = \frac{b}{2 P} = \frac{108}{2 \times 12} = 4.5 \dots\dots\dots 28$$

$$D' = \frac{2 a v}{v + V} = \frac{2 \times 4.5 \times 2}{3} = 6 \dots\dots\dots 29$$

$$d' = \frac{2 a V}{v + V} = \frac{2 \times 4.5 \times 1}{3} = 3 \dots\dots\dots 30$$

$$a = \frac{D' + d'}{2} = \frac{6 + 3}{2} = 4.5 \dots\dots\dots 31$$



## Collets.

For use on Milling and Gear Cutting Machines, Etc.



Style 1.

Style 2.



Style 3.

Style 4.



**Style 1A.** Similar to Style 1, but designed for shanks without tenons.

**Style 2A.** Similar to Style 2, but no threaded hole.

**Style 3A.** Similar to Style 3, but no threaded hole.

**Style 4A.** Straight hole through, front end 60° taper.

Mark.	Outside Taper.	Inside Taper.	Style.	Collet to Spindle.	Diameter of Threaded Hole.	Price.
LL	6	2	4	3-4"		\$1 50
A	7	4	1A	1 9-16		2 00
J	7	4	2A	5-16	3-8", 16, L. H.	2 00
N	7	5	1A	2 5-16		2 00
R	7	5	2A	3-4	3-8, 16, L. H.	2 00
C	9	5	1A	2 1-8		3 00
D	9	5	1A	3-8		2 75
K	9	5	2A	3-8	7-16, 14, L. H.	2 75
KK	9	7	1	3-4		3 25
RR	9	7	2	7-8	7-16, 14, L. H.	3 25
EE	10	5	1A	2 1-8		3 50
MM	10	6	4A	3-4		3 50
DD	10	7	1	2 5-8		3 50
E	10	7	1	1 5-8		3 50
BB	10	7	2	1 1-4	1-2, 14, L. H.	4 00
Z	10	7	2A	1-2		3 50
F	10	9	1	1		4 00
FF	10	9	2	1 1-4	1-2, 14, L. H.	4 00
Q	11	7	1	1 3-4		4 50
G	11	9	1	2 3-8		5 00
O	11	9	2	1-4	3-4, 12, L. H.	5 25
H	11	9	3	1 5-8	3-4, 12, L. H.	6 00
GG	11	10	3A	1-2		6 00
SS	12	9	2	7-16	3-4, 12, L. H.	6 00
T	12	9	3A	1 11-16		6 50
V	12	10	2	7-8	3-4, 12, R. H.	6 50
P	11	10	1	1 3-8		6 50
PP	12	10	3A	1 11-16		6 50
VV	12	11	2	1 7-8	3-4, 12, R. H.	6 50
TT	12	11	3A	1 11-16		6 50
UU	12	9	3	1 11-16	3-4, 12, L. H.	6 75
WW	14	10	2	7-8	3-4, 12, R. H.	8 00
W	14	11	2	7-8	3-4, 12, R. H.	8 00
WV	14	12	2	7-8	3-4, 12, R. H.	8 00
XX	16	11	2	7-8	7-8, 10, R. H.	10 00
X	16	12	2	7-8	7-8, 10, R. H.	10 00
YY	18	11	2	7-8	1, 10, R. H.	11 50
Y	18	14	2	7-8	1, 10, R. H.	13 00

Standard Tapers and Taper Holes, page 298.

## Collet Blanks.



Price includes Turning Plug and Knockout Key.

Diameter.	Length over all.	No. of Taper Hole.	Price.
3-4"	5 1-4"	4	\$1 50
1 1-8	8 1-2	5	2 00
1 5-8	10	7	2 50
1 5-8	12	9	3 50
2	14	10	4 50

## Standard Taper Holes.

To find the number of taper hole in spindle, measure the diameter of large end of hole and the corresponding taper may be found in the following list.

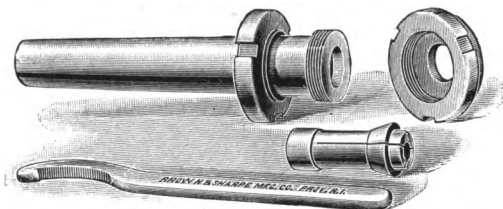
No. of Taper.	Approximate Diam. at Large End.	No. of Taper.	Approximate Diam. at Large End.
6	19-32"	12	1 13-16"
7	23-32	14	2 11-32
9	1 1-16	16	2 7-8
10	1 9-32	18	3 7-16
11	1 17-32		

## Standard Tapers

For Spindles, Collets, Arbors, &c.

No. of Taper	—	1	2	3	4	5	6	7	8	9
Diam. at small end—	.20"	.25"	.312"	.35"	.45"	.50"	.60"	.75"	.90"	
No. of Taper	—	10	11	12	13	14	15	16	17	18
Diam. at small end—	1.0446"	1.25"	1.50"	1.75"	2"	2.25"	2.50"	2.75"	3"	

## Spring Chucks for Milling Machines.



This Chuck is found convenient for holding wire, small rods, straight shank drills, mills, etc.

The Collet Holder is of steel, ground to fit a standard taper hole, and has a hole its entire length. The spring collet is held in place by a cap nut that forces it against the taper seat and closes the chuck centrally.

No. of Chuck.	No. of Outside Taper.	Hole Through.	Machines where used.	Round Collet Furnished.	Price.
150	7	5-16"	0 and 1 Vertical Spindle Att.	1-4"	\$9 00
152	9	1-2	1 Comp. and 1 Univ. Mill. Att.		
			00, 0 and 0Y Plain	5-16	9 00
			6 Universal Index Centres		
			1, 1A, 1D, 1AD, 2 and 2A Un.	3-8	11 00
154	10	21-32	1, 1B, 1Y, 1D, 1BD, 2, 2B and 2Y Plain		
			1 Vertical Spindle		
			10" & 12" Plain & 10" Universal Index Centres		
			2A Heavy, 3, 3A, 3A Heavy and 4A Universal	5-8	12 00
156	11	3-4	2 Heavy, 2B Heavy, 3, 3B, 3B Heavy and 4B Plain		
			2, 3 and 5 Vertical Spindle		
			4A Heavy Universal		
158	12	1	4B Heavy & 5B Heavy Plain	5-8	13 50
			12 1-2" Univ. Index Centres		

Standard Taper Holes, page 298.

## Spring Collets for Milling Machines.

For Nos. 150 and 152, Round 1-16" to 1-2", by 32ds	Price, each, \$2 25
Square or Hexagonal, made to order	Price, each, \$4 50
For No. 154, Round, 1-8" to 1-2", by 32ds; 9-16", 5-8"	Price, each, \$2 75
Square 3-16" and 1-4"	Price, each, \$4 50
Hexagonal, 1-4" and 5-16"	Price, each, \$4 50
For Nos. 156 and 158, Round, 3-16" to 1-2", by 32ds;	
9-16" to 1", by 16ths	Price, each, \$3 00
Square, 1-4", 5-16", 3-8", 7-16"	Price, each, \$4 75
Hexagonal, 1-4", 5-16", 3-8", 7-16", 1-2"	Price, each, \$4 75

Other sizes made to order.

# Milling Machine Cutter Arbors.



Style A.



Style B.



Style C.



Style D.



Style E.

No. of Arbor.	No. of Taper Shank.	Dia. of Arbor.	Length Shoulder to Nut.	Dia. of Hardened Sleeve.	Style.	Price.
04	7	1-2"	1"		A	\$3 50
05	7	1-2	3		A	4 00
07	9	5-8	4		A	4 50
08	9	7-8	5 1-4		A	5 00
09	9	1	5 1-4		A	5 00
010	9	5-8	8		A	6 50
011	9	7-8	8		A	6 50
012	9	1	8		A	6 50
1	10	5-8	4		A	5 00
6	10	7-8	5 1-4		A	6 00
7	10	1	5 1-4		A	6 00
†8	10	1 1-16	5 1-4		A	6 00
9	10	1 1-4	5 1-4		A	6 00
10	10	7-8	8		A	7 50
11	10	1	8		A	7 50
†12	10	1 1-16	8		A	7 50
13	10	1 1-4	8		A	7 50
40	10	7-8	12	1 13-16"	B	11 50
41	10	1	12	1 13-16	B	11 50
†42	10	1 1-16	12	1 13-16	B	11 50
43	10	1 1-4	12	1 13-16	B	11 50
44	10	7-8	17	1 13-16	B	12 50
45	10	1	17	1 13-16	B	12 50
†46	10	1 1-16	17	1 13-16	B	12 50
47	10	1 1-4	17	1 13-16	B	12 50
53	10	1	14 1-2	1 13-16	D	13 00
55	10	1 1-4	14 1-2	1 13-16	D	13 00
15	11	7-8	10 1-4		A	9 00
16	11	1	10 1-4		A	9 00
†17	11	1 1-16	10 1-4		A	9 00
18	11	1 1-4	10 1-4		A	9 00
48	11	7-8	16 1-4	2 1-16	B	13 50
49	11	1	17 3-4	2 1-16	B	13 50
†50	11	1 1-16	17 3-4	2 1-16	B	13 50
51	11	1 1-4	20 1-4	2 1-16	B	15 00
52	11	1 1-2	20 1-4	2 1-16	B	15 00
48-A	11	7-8	16 1-4	2 1-16	C	15 50

†These Arbors are not carried in stock but can be furnished at short notice.  
List continued on next page.

Standard Taper Holes, page 298.

# Milling Machine Cutter Arbors.

(Continued.)

No of Arbors.	No. of Taper Shank.	Dia. of Arbor.	Length Shoulder to Nut.	Dia. of Hardened Sleeve.	Style.	Price.
49-A	11	1"	17 3-4"	2 1-16"	C	\$15 50
†50-A	11	1 1-16	17 3-4	2 1-16	C	15 50
51-A	11	1 1-4	20 1-4	2 1-16	C	17 00
52-A	11	1 1-2	20 1-4	2 1-16	C	17 00
35	11	7-8	16	2 1-16	D	15 00
36	11	1	16	2 1-16	D	15 00
†37	11	1 1-16	16	2 1-16	D	15 00
38	11	1 1-4	19 1-2	2 1-16	D	16 00
39	11	1 1-2	19 1-2	2 1-16	D	16 00
35-A	11	7-8	16	2 1-16	E	17 00
36-A	11	1	16	2 1-16	E	17 00
†37-A	11	1 1-16	16	2 1-16	E	17 00
38-A	11	1 1-4	19 1-2	2 1-16	E	18 00
39-A	11	1 1-2	19 1-2	2 1-16	E	18 00
65	11	1	22	2 5-16	D	16 50
66	11	1 1-4	26 3-4	2 5-16	D	17 50
67	11	1 1-2	26 3-4	2 5-16	D	17 50
68	11	1 3-4	26 3-4	2 5-16	D	17 50
19-A	11	7-8	20	2 1-16	E	18 00
20-A	11	1	22	2 1-16	E	18 50
†21-A	11	1 1-16	22	2 1-16	E	18 50
22-A	11	1 1-4	24	2 1-16	E	19 00
23-A	11	1 1-2	24	2 1-16	E	19 00
65-A	11	1	22	2 5-16	E	18 50
66-A	11	1 1-4	26 3-4	2 5-16	E	19 50
67-A	11	1 1-2	26 3-4	2 5-16	E	19 50
68-A	11	1 3-4	26 3-4	2 5-16	E	19 50
69	12	1	25	2 9-16	D	17 00
70	12	1 1-4	29	2 9-16	D	18 00
71	12	1 1-2	29	2 9-16	D	18 00
71 1-2	12	1 3-4	29	2 9-16	D	18 00
72	12	2	29	2 9-16	D	18 00
69-A	12	1	25	2 9-16	E	19 50
70-A	12	1 1-4	29	2 9-16	E	20 50
71-A	12	1 1-2	29	2 9-16	E	20 50
71 1-2-A	12	1 3-4	29	2 9-16	E	20 50
72-A	12	2	29	2 9-16	E	20 50
75-A	12	1	30	2 9-16	E	21 00
76-A	12	1 1-4	35	2 9-16	E	22 00
77-A	12	1 1-2	35	2 9-16	E	22 00
78-A	12	1 3-4	35	2 9-16	E	22 00
79-A	12	2	35	2 9-16	E	22 00

†These Arbors are not carried in stock but can be furnished at short notice.  
Standard Taper Holes, page 298.

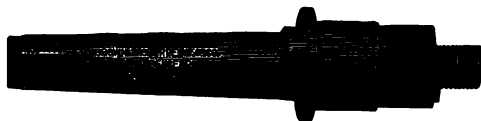
## Milling Machine Screw Arbors and Arbors for Coarse Tooth Shell End Mills.



Style A.



Style B.



Style C.

**Style D.**—Similar to Style C, but has threaded hole in end for drawing-in bolt.

No of Arbor	No. of Taper.	Dia. of Arbor.	Thread.	Style.	Price.
120	7	3-8"	20, L	A	\$2 00
122	9	1-2	16, L	A	3 00
128	10	1	10, L	B	5 50
†129	10	1	10, R	B	5 50
130	11	1	10, L	B	6 00
*131	10	1	10, L	D	5 50
†*132	10	1	10, R	D	5 50
133	11	1	10, L	C	7 00
†134	11	1	10, R	C	7 00
135	12	1	10, L	C	9 00
138	11	1	10, L	D	7 00
†139	11	1	10, R	D	7 00
142	11	1 1-4	8, L	C	8 00
†143	11	1 1-4	8, R	C	8 00
146	11	1 1-4	8, L	D	8 00
†147	11	1 1-4	8, R	D	8 00
150	12	1 1-4	8, L	C	9 00
†151	12	1 1-4	8, R	C	9 00
154	12	1 1-4	8, L	D	9 00
†155	12	1 1-4	8, R	D	9 00
158	11	1 1-2	8, L	C	8 00
†159	11	1 1-2	8, R	C	8 00
162	11	1 1-2	8, L	D	8 00

\*Does not have clutch drive.

Standard Tapers, page 298.

†These Arbors are not carried in stock, but can be furnished at short notice.  
List continued on next page.

## Milling Machine Screw Arbors and Arbors for Coarse Tooth Shell End Mills (Cont.)

No. of Arbor.	No. of Taper.	Dia. of Arbor.	Thread.	Style.	Price.
†163	11	1 1-2"	8, R	D	\$8 00
166	12	1 1-2	8, L	C	9 00
†167	12	1 1-2	8, R	C	9 00
170	12	1 1-2	8, L	D	9 00
†171	12	1 1-2	8, R	D	9 00

†These Arbors are not carried in stock, but can be furnished at short notice.  
Standard Tapers, page 298.

## Arbors for Shell End Mills.



**Style A.**



**Style B.**

No. of Arbor.	No. of Taper.	Diameter of Arbor.	Diameter Mills Arbor will take.	Style.	Price.
89	7	1-2"	1 1-4" to 1 1-2"	A	\$4 50
90	9	3-4	1 9-16 to 2 3-16	A	4 50
91	9	1	2 1-4 to 3	A	4 75
92	9	1-2	1 1-4 to 1 1-2	B	4 50
93	9	1-2	1 1-4 to 1 1-2	A	4 50
96	9	3-4	1 9-16 to 2 3-16	B	4 50
105	9	1	2 1-4 to 3	B	4 75
94	10	3-4	1 9-16 to 2 3-16	A	5 25
95	10	1	2 1-4 to 3	A	5 50
97	10	3-4	1 9-16 to 2 3-16	B	5 25
98	10	1	2 1-4 to 3	B	5 50
99	11	3-4	1 9-16 to 2 3-16	A	5 50
100	11	1	2 1-4 to 3	A	5 75
101	11	3-4	1 9-16 to 2 3-16	B	5 50
102	11	1	2 1-4 to 3	B	5 75
103	12	3-4	1 9-16 to 2 3-16	B	6 00
104	12	1	2 1-4 to 3	B	6 25

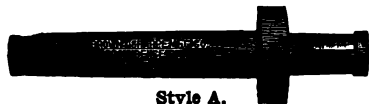
In ordering, state whether Arbor is for R. H. or L. H. Mill.

Morse Taper furnished when desired.

Standard Tapers and Taper Holes, page 298. List of Mills, pages 238 and 239.

## Arbors for Face Milling Cutters.

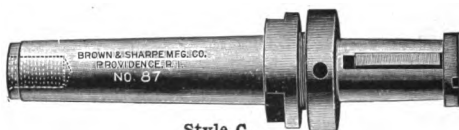
### With Inserted Teeth.



Style A.



Style B.



Style C.

Style D. Similar to Style C, but no threaded hole.

No. of Arbor.	No. of Taper of Shank.	No. of Taper for Mill.	Style.	Price.
79	10	10	A	\$8 00
82	11	12	A	10 00
81	11	12	B	10 00
80	11	10	C	12 00
83	11	12	C	12 00
87	12	12	C	12 00
84	11	12	D	12 00
85	12	12	D	12 00
86	12	10	C	12 00

Standard Tapers and Taper Holes, page 298.

## Screw Slotting Cutter Arbors.



These Arbors are for use with Screw Slotting Cutters and are adapted for use on Centres. They are also made with No. 7 Taper Shank for use on the Screw Slotting Machine. The following sizes are carried in stock: 3-8", 1-2", 5-8", 3-4", 7-8", 1". Price, each, \$3 50.

For List of Screw Slotting Cutters, see pages 243 and 244.



# Fly Cutter Arbors.

FOR MILLING MACHINES.



The hole in the head is 3-4" square.

No. of Arbor.	No. of Taper.	Price.
110	10	\$6 50
112	11	8 00
113	12	9 00

Price includes tool with 1-8" radius.

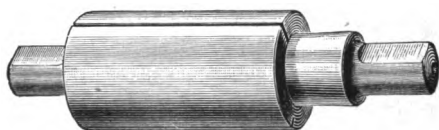
Standard Tapers, page 298.

## Index Plates.

For Use on Universal Milling Machines.

No.	Machine where used.	Diameter of Plate.	Hole in Centre	Number of Holes in Each Circle.	Price.
1	No. 1 Prior to 1900	4 3-4"	1 1-8"	15 16 17 18 19 20	\$2 50
2		4 3-4	1 1-8	21 23 27 29 31 33	2 50
3		4 3-4	1 1-8	37 39 41 43 47 49	2 50
7	Nos. 1, 1A, 1D, 1AD, 2 & 2A	5	1 1-8	15 16 17 18 19 20	2 50
8		5	1 1-8	21 23 27 29 31 33	2 50
9		5	1 1-8	37 39 41 43 47 49	2 50
13	2A Heavy, 3 & 3A	6 1-4	1 1-2	15 16 17 18 19 20	3 50
14		6 1-4	1 1-2	21 23 27 29 31 33	3 50
15		6 1-4	1 1-2	37 39 41 43 47 49	3 50
20	No. 4 Prior to 1893	6 15-16	1 1-2	15 16 17 18 19 20	3 50
21		6 15-16	1 1-2	21 23 27 29 31 33	3 50
22		6 15-16	1 1-2	37 39 41 43 47 49	3 50
28	3A Heavy, 4A & 4A Heavy	7 1-2	1 3-4	15 16 17 18 19 20	3 50
29		7 1-2	1 3-4	21 23 27 29 31 33	3 50
30		7 1-2	1 3-4	37 39 41 43 47 49	3 50

# Taper Mandrels and Expansion Bushings.



## TAPER MANDRELS.

Mandrel No.	Whole Length.	Diam. at Small End.	Price.	Mandrel No.	Whole Length.	Diam. at Small End.	Price.
3	3 11-16"	.3125"	\$1 40	9	7 3-16"	.90"	\$2 60
4	4 1-16	.35	1 50	10	7 3-4	1.05	3 00
5	4 1-2	.45	1 65	11	8 3-8	1.25	3 50
6	5 1-8	.50	1 80	12	9	1.50	4 00
7	5 15-16	.60	2 00	13	9 5-8	1.75	4 75
8	6 9-16	.75	2 25				

Mandrels take Bushings as follows: No. 3, 2 sizes; Nos. 4, 5, 6, 7 and 8, 3 sizes; Nos. 9, 10, 11, 12 and 13, 6 sizes.

## EXPANSION BUSHINGS.

Outside Diameter of Bushing.	Length.	For Mandrel No.	Price.	Outside Diameter of Bushing	Length.	For Mandrel No.	Price.
1-2"	1 1-2"	3	\$0 55	2"	4"	10	\$2 00
9-16	1 5-8	3	55	2 1-16	4 1-8	10	2 00
5-8	1 3-4	4	65	2 1-8	4 1-8	10	2 00
11-16	1 7-8	4	65	2 3-16	4 1-4	10	2 00
3-4	2	4	65	2 1-4	4 1-4	10	2 00
13-16	2 1-8	5	80	2 5-16	4 3-8	11	2 40
7-8	2 1-4	5	80	2 3-8	4 3-8	11	2 40
15-16	2 3-8	5	80	2 7-16	4 1-2	11	2 40
1	2 1-2	6	95	2 1-2	4 1-2	11	2 40
1 1-16	2 5-8	6	95	2 9-16	4 5-8	11	2 40
1 1-8	2 3-4	6	95	2 5-8	4 5-8	11	2 40
1 3-16	2 7-8	7	1 15	2 11-16	4 3-4	12	2 80
1 1-4	3	7	1 15	2 3-4	4 3-4	12	2 80
1 5-16	3 1-8	7	1 15	2 13-16	4 7-8	12	2 80
1 3-8	3 1-4	8	1 40	2 7-8	4 7-8	12	2 80
1 7-16	3 3-8	8	1 40	2 15-16	5	12	2 80
1 1-2	3 1-2	8	1 40	3	5	12	2 80
1 9-16	3 5-8	9	1 70	3 1-16	5 1-8	13	3 20
1 5-8	3 5-8	9	1 70	3 1-8	5 1-8	13	3 20
1 11-16	3 3-4	9	1 70	3 3-16	5 1-4	13	3 20
1 3-4	3 3-4	9	1 70	3 1-4	5 1-4	13	3 20
1 13-16	3 7-8	9	1 70	3 5-16	5 3-8	13	3 20
1 7-8	3 7-8	9	1 70	3 3-8	5 3-8	13	3 20
1 15-16	4	10	2 00				

## Lathe Mandrels.



These Mandrels are of tool steel, hardened and accurately ground. They are tapered .0005" to one inch.

The Mandrels from 1-4" to 1" are .0005" below size at the small end; and from 1 1-16" to 4" .001" below size at the small end.

Diameter.	Total Length.	Price.	Diameter.	Total Length.	Price.
1-4"	3 3-4"	\$0 65	2 3-16"	12"	\$6 00
5-16	4	75	2 1-4	12	6 50
3-8	4 1-4	85	2 5-16	12	6 90
7-16	4 1-2	95	2 3-8	12	7 40
1-2	5	1 05	2 7-16	12 1-2	7 90
9-16	5 1-4	1 15	2 1-2	12 1-2	8 40
5-8	5 1-2	1 25	2 9-16	12 1-2	8 90
11-16	5 3-4	1 35	2 5-8	12 1-2	9 40
3-4	6	1 45	2 11-16	13	9 90
13-16	6 1-4	1 55	2 3-4	13	10 50
7-8	6 1-2	1 70	2 13-16	13	11 00
15-16	6 3-4	1 85	2 7-8	13	11 50
1	7	2 00	2 15-16	13	12 00
1 1-16	7 1-4	2 10	3	13	12 50
1 1-8	7 1-2	2 20	3 1-16	14	13 00
1 3-16	7 3-4	2 30	3 1-8	14	13 40
1 1-4	8	2 45	3 3-16	14	13 80
1 5-16	8 1-4	2 60	3 1-4	14	14 10
1 3-8	8 1-2	2 75	3 5-16	15	14 40
1 7-16	8 3-4	2 90	3 3-8	15	14 70
1 1-2	9	3 10	3 7-16	15	15 00
1 9-16	9 1-4	3 30	3 1-2	15	15 30
1 5-8	9 1-2	3 50	3 9-16	16	15 60
1 11-16	9 3-4	3 70	3 5-8	16	15 90
1 3-4	10	3 90	3 11-16	16	16 20
1 13-16	10 1-4	4 10	3 3-4	16	16 50
1 7-8	10 1-2	4 35	3 13-16	17	16 80
1 15-16	10 3-4	4 60	3 7-8	17	17 20
2	11	4 80	3 15-16	17	17 60
2 1-16	11 1-2	5 15	4	17	18 00
2 1-8	11 1-2	5 60			

# Expansion Bushings for Work Arbors.

## For Automatic Gear Cutting Machines.

Outside Diameter.	Machine where used.	Length.	No. Taper Holes.	Used with Arbor.	Price.
7-8"	No. 12	1 1-2"	7	G	\$0 90
1	No. 12	1 1-2	7	G	90
1 1-8	No. 12	1 1-2	7	G	90
1 1-4	No. 12	1 1-2	7	G	90
3-4	3, 12 & 13	3	6	E & I	1 00
7-8	3, 12 & 13	3	6	E & I	1 00
1	3, 12 & 13	3	6	E & I	1 00
1 1-8	3, 12 & 13	3	6	E & I	1 00
1 1-4	3, 12 & 13	3 1-2	9	F & J	1 30
1 3-8	3, 12 & 13	3 1-2	9	F & J	1 55
1 1-2	3, 12 & 13	3 1-2	9	F & J	1 55
1 5-8	3, 12 & 13	3 1-2	9	F & J	1 90
1 3-4	Nos. 3 & 13	3 1-2	11	K	1 90
2	Nos. 3 & 13	3 1-2	11	K	2 20
2 1-4	Nos. 3 & 13	3 1-2	11	K	2 20
1	3H, 4 & 13H	3 1-2	7	M	1 05
1 1-8	3H, 4 & 13H	3 1-2	7	M	1 05
1 1-4	3H, 4 & 13H	3 1-2	7	M	1 30
1 3-8	3H, 4 & 13H	3 1-2	7	M	1 55
1 1-2	3H, 4 & 13H	5	10	N & P	1 55
1 5-8	3H, 4 & 13H	5	10	N & P	1 90
1 3-4	3H, 4 & 13H	5	10	N & P	1 90
2	3H, 4 & 13H	5	10	N & P	2 20
2	3H, 4 & 13H	5	12	O & T	2 20
2 1-4	3H, 4 & 13H	5	12	O & T	2 20
2 1-2	3H, 4 & 13H	5	12	O & T	2 65
2 3-4	3H, 4 & 13H	5	12	O & T	3 10
3	3H, 4 & 13H	5	12	O & T	3 50
1 1-2	No. 5	4 1-2	10	Q	1 55
1 5-8	No. 5	4 1-2	10	Q	1 90
1 3-4	No. 5	4 1-2	10	Q	1 90
2	No. 5	4 1-2	10	Q	2 20
2 1-4	No. 5	4 1-2	10	Q	2 20
*2 1-2	No. 5	6	13	R	2 65
*2 3-4	No. 5	6	13	R	3 10
†*3	No. 5	6	13	R	3 50
*3 1-4	No. 5	6	13	R	3 50
3 1-4	No. 5	6	14	S	3 50
*3 1-2	No. 5	6	13	R	3 60
3 1-2	No. 5	6	14	S	3 60
2 1-4	No. 6	6	12	U	2 20

In ordering, state outside diameter, and letter of Arbor.

Bushings marked \* can be used on Withdrawing Work Arbors furnished

Bushings marked † are furnished with the machine.

List continued on next page.

# Expansion Bushings for Work Arbors

## For Automatic Gear Cutting Machines.

(Continued.)

Outside Diameter.	Machine where used.	Length.	No. Taper Holes.	Used with Arbor.	Price.
2 1-2"	No. 6	6"	12	U	\$2 65
2 3-4	No. 6	6	12	U	3 10
*3	No. 6	7 1-2	14	V	3 65
*3 1-4	No. 6	7 1-2	14	V	3 80
*3 1-2	No. 6	7 1-2	14	V	4 00
*3 3-4	No. 6	7 1-2	14	V	4 15
†*4	No. 6	7 1-2	14	V	4 30
4	No. 6	9	18	W	4 50
4 1-2	No. 6	9	18	W	5 00
5	No. 6	9	18	W	5 50

In ordering, state outside diameter and letter of Arbor.

Bushings marked \* can be used on Withdrawing Work Arbors furnished.

Bushings marked † are furnished with the machine.

# Work Arbors

## For Automatic Gear Cutting Machines.



Mark.	Machine where used.	No. of Taper of Shank.	Length of Bushing.	No. of Taper for Bushing.	Smallest Possible Bushing.	Price.
†D	No. 12	7				\$4 00
E	No. 12	10	3"	6	3-4"	8 50
F	No. 12	10	3 1-2	9	1 1-4	8 50
G	No. 12	10	1 1-2	7	7-8	8 00
*I	Nos. 3 & 13	10	3	6	3-4	9 00
J	Nos. 3 & 13	12	3 1-2	9	1 1-4	14 00
K	Nos. 3 & 13	12	3 1-2	11	1 3-4	14 00
*M	3H, 4 & 13H	11	3 1-2	7	1	10 00
†N	Nos. 3H & 4	14	5	10	1 1-2	16 00
†O	Nos. 3H & 4	14	5	12	2	16 00
P	No. 13H	14	5	10	1 1-2	15 00
*Q	No. 5	12	4 1-2	10	1 1-2	14 00
†R	No. 5	16	6	13	2 1-2	20 00
†S	No. 5	16	6	14	3 1-4	20 00
T	No. 13H	14	5	12	2	15 00
†*U	No. 6	14	6	12	2 1-4	18 00
†V	No. 6	18	7 1-2	14	3	22 00
†W	No. 6	18	9	18	4	24 00

Arbors marked \* are for use in the Collets.

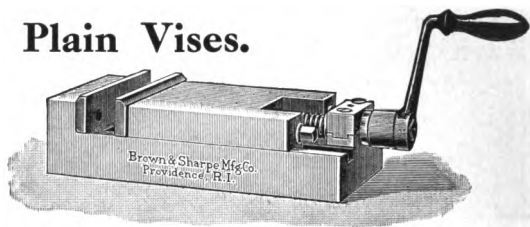
† Straight arbor; length from shoulder to nut 3", diameter 1-2".

† These arbors differ from one shown in cut in having a teat or straight end extending beyond nut and fitting into the bushing of outer support furnished with the Nos. 3H, 4, 5 and 6 machines.

## Plain Vises.

**For use upon  
Milling or Planing  
Machines.**

Jaws of hardened steel  
unless otherwise specified.



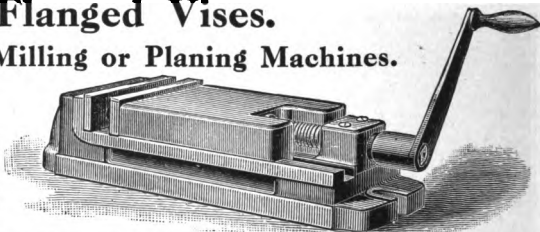
Size.	Width of Jaws.	Depth of Jaws.	Jaws Open.	Weight.	Price.
No. 1-P	4 1-8"	1 1-16"	2"	16 lbs.	\$14 00
No. 2-P	5 1-8	1 1-4	2 3-4	24 lbs.	15 00
No. 3-P	6 1-8	1 9-16	3 5-8	43 lbs.	20 00
No. 4-P	7 1-8	2	4 1-2	78 lbs.	31 00

## Flanged Vises.

**For use upon Milling or Planing Machines.**

Jaws of hardened steel  
unless otherwise specified.

These Vises are provided  
with flanges for clamping  
them to the table of Milling or  
Planing Machines. Furnished  
with bolts, nuts, washers and  
clamp.



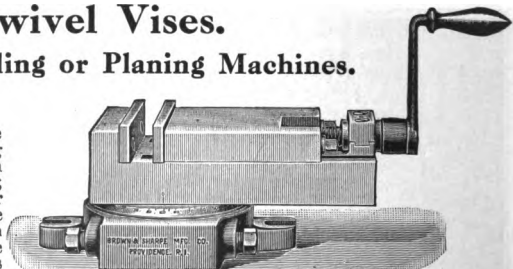
Size.	Width of Jaws.	Depth of Jaws.	Jaws Open.	Weight.	Price.
No. 1-F	4 1-8"	1 1-16"	2"	16 lbs.	\$15 00
No. 2-F	5 1-8	1 1-4	2 3-4	28 lbs.	17 00
No. 3-F	6 1-8	1 9-16	3 5-8	50 lbs.	26 00
No. 4-F	7 1-8	2	4 1-2	95 lbs.	38 00
No. 5-F	8 5-8	2 1-2	7	180 lbs.	53 00

## Swivel Vises.

**For use upon Milling or Planing Machines.**

Jaws of hardened steel  
unless otherwise specified.

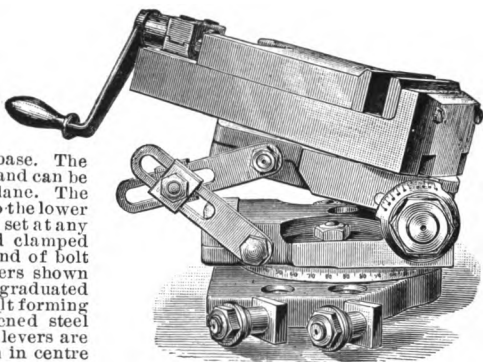
The vise is clamped to the base  
by either one of the two clamping  
bolts. The vises are furnished with  
tongues as follows: No. 2-S, 5-8";  
Nos. 3-S and 4-S, reversible for  
either 5-8" or 3-4" slots and can be  
used on any table fitted with  
corresponding T slots. They are  
also furnished with bolts, nuts  
and washers.



Size.	Width of Jaws.	Depth of Jaws.	Jaws Open.	Height.	Weight.	Price.
No. 2-S	5 1-8"	1 1-4"	2 3-4"	4 1-2"	45 lbs.	\$20 00
No. 3-S	6 1-8	1 9-16	3 5-8	5 3-16	70 lbs.	28 00
No. 4-S	7 1-8	2	4 1-2	6 3-8	110 lbs.	40 00

## Tool Makers Universal Visers.

The base is double. The lower part is provided with a reversible tongue which can be used in a 5-8" or 3-4" T slot and is fastened to the table by two bolts, which fit into the table T slots. It has two sets of slots to allow for moving the vise back when set in a vertical plane. The upper part is a hinged knee, which swivels on the lower part of the base. The lower part of the knee is graduated and can be set at any angle in a horizontal plane. The upper part of the knee is hinged to the lower part in such a manner that it can be set at any angle to 90° in a vertical plane and clamped rigidly in position by the nut on end of bolt forming the hinge and bracing levers shown at left of cut. The upper surface is graduated for setting the vise proper. The bolt forming the hinge is provided with a hardened steel dial graduated to 90°. The bracing levers are held in position by the bolt shown in centre and the bolts at the ends of the levers.



The vise proper swivels on the upper part of the hinged knee, can be set at any angle to the axis of the bolt forming the hinge and clamped in position by the bolt which holds the upper bracing lever.

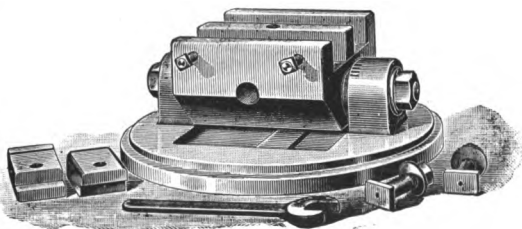
The jaws are made of tool steel, hardened. Each vise is furnished with a wrench.

Dimensions of boxes in which vises are shipped: No. 2-T, 17" x 12" x 9"; No. 3-T, 21" x 14" x 11".

No.	Width of Jaws.	Depth of Jaws.	Jaws Open.	Net Weight.	Shipping Weight.	Price.
2-T	5 1-8"	1 1-4"	2 3-4"	65 lbs.	80 lbs.	\$50 00
3-T	6 1-8	1 9-16	3 5-8	135 lbs.	160 lbs.	65 00

## Adjustable Swivel Vise.

Adapted for use on Planing and Surface Grinding Machines.



This Vise can be set at any angle with the T slots of the table and is pivoted so that it can be set at any angle to 40 degrees either side of the horizontal. Bolts, nuts, washers and clamp are furnished. Height of vise, 4".

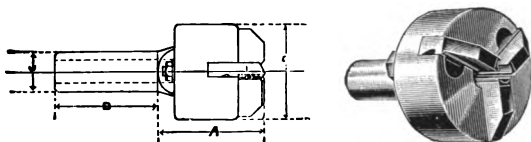
The jaws are 5" wide, 1" deep, and will open 2 3-4".

**Weights.** Net, about 30 lbs.; ready for shipment, about 40 lbs. Dimensions for shipment, 13" x 12" x 6".

Price, \$22 00.

## Adjustable Hollow Mills

### With Inserted Blades.



### ROUGHING.

Each holder is furnished with one set of blades (3) of any regular size required. Blades turn large as follows: 1-4" to 7-16", about .012"; 1-2" to 3-4", about .016"; 13-16" to 1 1-8", about .02". Blades for Nos. 3, 4 and 5 interchangeable. Set of blades turns one size only, except where noted.

No. of Mill.	Number of Machine where used.	Capacity.	A Length of Body and Blades.	B Diameter Outside.	C Diameter Shank.	D Length Shank.	Price with one Set of Carbon Steel Blades.	Price with one Set of High Speed Steel Blades.	Price of extra Carbon Steel Blades, per Set.	Price of extra High Speed Steel Blades, per Set.
		In.	In.	In.	In.	In.				
+00	00, 00G & 19 Auto.	.03 to $\frac{3}{8}$	$1\frac{1}{8}$	$1\frac{1}{2}$	$\frac{5}{8}$	$1\frac{1}{8}$	\$6 75	\$7 25	\$1 25	\$1 75
+0	0 Wire Feed	.03 to $\frac{3}{8}$	$1\frac{1}{4}$	$1\frac{3}{4}$	$\frac{5}{8}$	$1\frac{7}{8}$	11 00	11 75	2 00	2 75
1 {	1 Pl. begining 230*	$\frac{3}{8}$ to $\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{4}$	$\frac{3}{4}$	2	12 25	13 25	3 50	4 50
	1 Wire Feed									
3 {	2 Pl. begining 455*	$\frac{1}{4}$ to $\frac{3}{4}$	$3\frac{1}{4}$	3	1	$2\frac{1}{2}$	13 25	14 75	4 25	5 50
	2 Wire Feed									
4 {	4 Pl. prior to 428*	$\frac{1}{4}$ to $\frac{3}{4}$	$3\frac{1}{4}$	3	$1\frac{1}{8}$	$3\frac{1}{4}$	13 25	14 75	4 25	5 50
	5 Pl. prior to 428*									
5 {	6 Pl. prior to 59*	$\frac{1}{4}$ to $\frac{3}{4}$	$3\frac{1}{4}$	3	$1\frac{1}{4}$	$3\frac{1}{4}$	13 25	14 75	4 25	5 50
6 {	4 Pln. 428 to 601*	$\frac{1}{2}$ to $1\frac{1}{8}$	$3\frac{3}{8}$	$3\frac{1}{2}$	$1\frac{1}{2}$	$3\frac{1}{4}$	15 50	17 00	5 00	6 00
	4 W.F. prior to 23*									
	5 Pln. 428 to 581*									
	6 Plain 59 to 230*									
24	4 & 5 pln.; 4 W.F.	$\frac{1}{2}$ to $1\frac{3}{8}$	$3\frac{3}{8}$	$3\frac{1}{2}$	$1\frac{3}{4}$	$3\frac{1}{4}$	16 50	18 25	5 00	6 00
26	6 Plain & 6 W.F.	$\frac{1}{2}$ to $1\frac{3}{8}$	$3\frac{3}{8}$	$3\frac{3}{4}$	2	$3\frac{1}{4}$	17 50	19 25	5 00	6 00

\*Be sure to give serial numbers of machines.

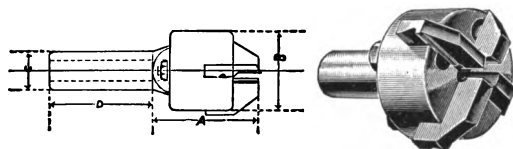
†One set of blades turns all sizes within capacity.

The stock sizes of blades run by 16ths of an inch between the limits given under "Capacity," except on Nos. 00 and 0 Mills.



# Adjustable Hollow Mills

## With Inserted Blades.



### FINISHING.

The Finishing Mills have 2 blades and 2 back rests which will turn any size within the capacity of the mill.

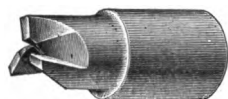
Two extra blades are included in "Price of Mill Complete." As the blades wear much faster than the back rests it is more economical to use blades opposite back rests.

Blades for Nos. 13, 14 and 15 interchange.

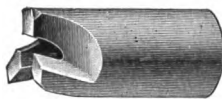
No. of Mill.	Number of Machine where used.	Capacity.	Length of Body and Blades.	Diameter Outside.	Diameter Shank.	Length Shank.	Price of Mill Complete with Carbon Steel Blades.	Price of Mill Complete with High Spd. Steel Blades.	Price of 4 Carbon Steel Blades and 2 Back Rests.	Price of 4 High Speed Steel Blades and 2 Back Rests.
		In.	In.	In.	In.	In.				
100	00, 00G & 19 Auto.	.03 to $\frac{3}{8}$	$1\frac{3}{8}$	$1\frac{1}{2}$	$\frac{5}{8}$	$1\frac{1}{8}$	\$7 75	\$8 50	\$2 25	\$3 00
10	0 Wire Feed	.03 to $\frac{3}{8}$	$1\frac{1}{4}$	$1\frac{3}{4}$	$\frac{5}{8}$	$1\frac{1}{8}$	13 25	14 50	3 75	4 75
11 {	1 Pl. begining 230*	$\frac{3}{16}$ to $\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{4}$	$\frac{3}{4}$	2	14 50	15 75	4 50	5 75
	1 Wire Feed									
13 {	2 Pl. begining 455*	$\frac{1}{4}$ to $\frac{3}{4}$	$3\frac{1}{4}$	3	1	$2\frac{1}{2}$	15 50	17 50	5 25	7 25
	2 Wire Feed									
14 {	4 Pl. prior to 428*	$\frac{1}{4}$ to $\frac{3}{4}$	$3\frac{1}{4}$	3	$1\frac{1}{8}$	$3\frac{1}{4}$	15 50	17 50	5 25	7 25
	5 Pl. prior to 428*									
15 {	6 Pl. prior to 59*	$\frac{1}{4}$ to $\frac{3}{4}$	$3\frac{1}{4}$	3	$1\frac{1}{4}$	$3\frac{1}{4}$	15 50	17 50	5 25	7 25
16 {	4 Pln. 428 to 601*	$\frac{1}{2}$ to $1\frac{1}{8}$	$3\frac{3}{8}$	$3\frac{1}{2}$	$1\frac{1}{2}$	$3\frac{1}{4}$	17 75	20 00	5 50	8 00
	4 W.F. prior to 23*									
	5 Pln. 428 to 581*									
	6 Plain 59 to 230*									
34	4 & 5 Pln. ; 4 W.F.	$\frac{1}{2}$ to $1\frac{1}{4}$	$3\frac{3}{8}$	$3\frac{1}{2}$	$1\frac{3}{4}$	$3\frac{1}{4}$	18 75	21 25	5 50	8 00
36	6 Plain & 6 W.F.	$\frac{1}{2}$ to $1\frac{3}{8}$	$3\frac{3}{8}$	$3\frac{3}{4}$	2	$3\frac{1}{4}$	20 00	22 25	5 50	8 00

\*Be sure to give serial numbers of machines.

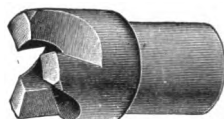
## Plain Hollow Mills.



Style 1.



Style 2.



Style 3.

The Plain Hollow Mills are designed for use in the turrets of screw machines for roughing cuts.

They are made with two forms of teeth, one undercut, as shown in above illustrations, for milling steel, and one straight, for milling brass.

These mills turn large as follows: up to and including 7-32", approximately .007"; 1-4" to 11-16" inclusive, approximately .011".

No. of Mill.	Style.	No. of Machine where used.	Sizes Carried in Stock.	Diameter of Shank.	Length of Shank.	Diameter of Head.	Length of Head.	Total Length.	Carbon Steel Mills, Price Each.	High Speed Steel Mills, Price Each.
00A	1	00, 00G & 19 Auto. }	$\frac{1}{8}$ " to $\frac{1}{8}$ " by 64ths.	No. 5 Taper	$\frac{5}{8}$ "	$\frac{3}{8}$ "	$\frac{1}{2}$ "	$1\frac{1}{8}$ "	\$1 00	\$1 50
*00B	1	00, 00G & 19 Auto. }	$\frac{9}{32}$ " to $\frac{7}{32}$ " by 64ths.	No. 5 Taper	$\frac{5}{8}$ "	$\frac{1}{2}$ "	$\frac{1}{2}$ "	$1\frac{1}{8}$ "	1 00	1 50
00C	2	00, 00G & 19 Auto. }	$\frac{1}{8}$ " to $\frac{3}{8}$ " by 32ds.	No. 5 Taper	$\frac{5}{8}$ "	$\frac{3}{4}$ "	$\frac{7}{8}$ "	$1\frac{3}{4}$ "	1 50	2 00
*00D	2	00, 00G & 19 Auto. }	$\frac{1}{8}$ " to $\frac{3}{8}$ " by 32ds.	No. 5 Taper	$\frac{5}{8}$ "	$\frac{3}{4}$ "	$\frac{7}{8}$ "	$1\frac{3}{4}$ "	1 50	2 00
20A	3	{ 0 & 0G Au. } { 1 W. F. }	$\frac{1}{8}$ " to $\frac{3}{8}$ " by 32ds.	$\frac{3}{4}$ "	$1\frac{3}{8}$ "	$1\frac{1}{4}$ "	$1\frac{1}{8}$ "	$2\frac{1}{4}$ "	2 00	2 75
*20B	3	{ 0 & 0G Au. } { 1 W. F. }	$\frac{1}{8}$ " to $\frac{3}{8}$ " by 32ds.	$\frac{3}{4}$ "	$1\frac{3}{8}$ "	$1\frac{1}{4}$ "	$1\frac{1}{8}$ "	$2\frac{1}{4}$ "	2 00	2 75
21A	2	1 Auto. }	$\frac{1}{4}$ " to $\frac{7}{16}$ " by 32ds.	1"	$1\frac{3}{8}$ "	$1\frac{1}{4}$ "	$1\frac{1}{8}$ "	$2\frac{1}{4}$ "	2 00	2 75
*21B	2	1 Auto. }	$\frac{1}{4}$ " to $\frac{7}{16}$ " by 32ds.	1"	$1\frac{3}{8}$ "	$1\frac{1}{4}$ "	$1\frac{1}{8}$ "	$2\frac{1}{4}$ "	2 00	2 75
22A	2	2 & 2G Au. }	$\frac{1}{4}$ " to $\frac{7}{16}$ " by 32ds.	1"	$1\frac{3}{8}$ "	$1\frac{1}{4}$ "	$1\frac{1}{8}$ "	$2\frac{1}{4}$ "	2 00	2 75
*22B	2	2 W. F. }	$\frac{1}{4}$ " to $\frac{7}{16}$ " by 32ds.	1"	$1\frac{3}{8}$ "	$1\frac{1}{4}$ "	$1\frac{1}{8}$ "	$2\frac{1}{4}$ "	2 00	2 75
22C	3	2 & 2G Au. }	$\frac{1}{32}$ " to $\frac{11}{32}$ " by 32ds.	1"	$1\frac{3}{8}$ "	$1\frac{1}{4}$ "	$1\frac{1}{8}$ "	$2\frac{1}{4}$ "	2 00	2 75
*22D	3	2 W. F. }	$\frac{1}{32}$ " to $\frac{11}{32}$ " by 32ds.	1"	$1\frac{3}{8}$ "	$1\frac{1}{4}$ "	$1\frac{1}{8}$ "	$2\frac{1}{4}$ "	2 00	2 75

\* For Brass.

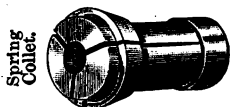
## Hollow Mill Blanks.

The shanks of the blanks are finished and drilled. State style wanted when ordering.

Style.	Machine where used.	Carbon Steel. Price Each.	High Speed Steel. Price Each.
Styles 1 or 2	Nos. 00, 00G & 19 Automatic	\$0 25	\$0 40
Style 3	Nos. 0 & 0G Automatic	30	60
Style 2	No. 1 Automatic	45	
Style 2	Nos. 2 & 2G Automatic	45	1 25
Style 3	Nos. 2 & 2G Automatic	45	1 50

# Spring Collets and Feeding Fingers

For Automatic and Wire Feed Screw Machines.



Feeding Finger.

## Nos. 00, 00G and 19 Automatic.

No. 00 Spring Collets.		Price Each.
Round:	1-16", 5-64", 3-32", 7-64", 1-8", 9-64", 5-32", 11-64", 3-16", 13-64", 7-32", 15-64", 1-4", 17-64", 9-32", 19-64", 5-16"	\$2 25
Square:	3-32", 1-8", 5-32", 3-16"	4 50
Hexagonal:	1-8", 5-32", 3-16", 7-32", 1-4"	4 50
Metric, Round:	2 m/m to 8 m/m, varying by 1-2 m/m	2 25
Collet Blanks		1 25

No. 00 Feeding Fingers.		
Round:	1-16", 5-64", 3-32", 7-64", 1-8", 9-64", 5-32", 11-64", 3-16", 13-64", 7-32", 15-64", 1-4", 17-64", 9-32", 19-64", 5-16"	1 25
Square:	3-32", 1-8", 5-32", 3-16"	2 25
Hexagonal:	1-8", 5-32", 3-16", 7-32", 1-4"	2 25
Metric, Round:	2 m/m to 8 m/m, varying by 1-2 m/m	1 25
Feeding Finger Blanks		60

No. 00 Spring Collets, for use with 3-8" Feed Tube.		
Round:	11-32", 3-8"	2 25
Square:	1-4"	4 50
Hexagonal:	5-16"	4 50
Metric, Round:	8 1-2, 9, 9 1-2 m/m	2 25

*No. 00A Feeding Fingers, for 3-8" Feed Tube.		
Round:	11-32", 3-8"	1 25
Square:	1-4"	2 25
Hexagonal:	5-16"	2 25
Metric, Round:	8 1-2, 9, 9 1-2 m/m	1 25

## Nos. 0 and 0G Automatic, also

### No. 1 Wire Feed (Prior to Machine Serial No. 227.)

No. 11 Spring Collets.		
Round:	1-8", 9-64", 5-32", 11-64", 3-16", 13-64", 7-32", 15-64", 1-4", 17-64", 9-32", 19-64", 5-16", 21-64", 11-32", 23-64", 3-8", 25-64", 13-32", 7-16", 15-32", 1-2"	\$2 75
Square:	3-16", 1-4", 5-16", 3-8"	4 50
Hexagonal:	3-16", 1-4", 5-16", 3-8", 7-16"	4 50
Metric, Round:	6 m/m to 12 m/m, varying by 1-2 m/m	2 75
Collet Blanks		1 50

\*Two feed tubes are furnished with No. 19 Automatic, one taking No. 00 Feeding Fingers and the other No. 00A Feeding Fingers. 3-8" Feed Tube for Nos. 00 and 00G Automatics is furnished as an extra.

List continued on next page.

Other sizes made to order.

## Spring Collets and Feeding Fingers (Cont.)

No. 11 Feeding Fingers.		Price Each.
Round:	1-8", 9-64", 5-32", 11-64", 3-16", 13-64", 7-32", 15-64", 1-4", 17-64", 9-32", 19-64", 5-16", 21-64", 11-32", 23-64", 3-8", 25-64", 13-32", 7-16", 15-32", 1-2"	\$1 75
Square:	3-16", 1-4", 5-16", 3-8"	2 50
Hexagonal:	3-16", 1-4", 5-16", 3-8", 7-16"	2 50
Metric, Round:	6 m/m to 12 m/m, varying by 1-2 m/m	1 75
Feeding Finger Blanks		85

### No. 0 and 0G Automatic.

No. 11 Spring Collets, for use with 5-8" Feed Tube.		Price Each.
Round:	17-32", 9-16", 19-32", 5-8"	\$2 75
Hexagonal:	1-2"	4 50
Metric, Round:	12 1-2 m/m to 16 m/m, varying by 1-2 m/m	2 75

### No. 11A Feeding Fingers, for 5-8" Feed Tube.

Round:	17-32", 9-16", 19-32", 5-8"	1 75
Hexagonal:	1-2"	2 50
Metric, Round:	12 1-2 m/m to 16 m/m, varying by 1-2 m/m	1 75

### No. 10 Spring Collets. No. 0 Wire Feed.

Round:	1-16", 3-32", 7-64", 1-8", 9-64", 5-32", 11-64", 3-16", 13-64", 7-32", 15-64", 1-4", 17-64", 9-32", 19-64", 5-16", 11-32", 3-8"	\$2 75
Square:	3-16", 1-4"	4 50
Hexagonal:	3-16", 1-4", 5-16"	4 50
Metric, Round:	4 m/m to 10 m/m, varying by 1-2 m/m	2 75
Collet Blanks		1 50

### No. 10 Feeding Fingers.

Round:	1-16", 3-32", 7-64", 1-8", 9-64", 5-32", 11-64", 3-16", 13-64", 7-32", 15-64", 1-4", 17-64", 9-32", 19-64", 5-16", 11-32", 3-8"	1 75
Square:	3-16", 1-4"	2 50
Hexagonal:	1-4", 5-16", 3-8", 7-16"	2 50
Metric, Round:	4 m/m to 10 m/m, varying by 1-2 m/m	1 75
Feeding Finger Blanks		85

### No. 1 Automatic, also

#### No. 1 Wire Feed (Commencing Machine Serial No. 227.)

### No. 21 Spring Collets.

Round:	1-8", 5-32", 3-16", 7-32", 1-4", 9-32", 5-16", 11-32", 3-8", 13-32", 7-16", 15-32", 1-2", 17-32", 9-16", 5-8"	\$3 00
Square:	1-4", 5-16", 3-8", 7-16"	4 75
Hexagonal:	1-4", 5-16", 3-8", 7-16", 1-2"	4 75
Metric, Round:	6 m/m to 16 m/m, varying by 1-2 m/m	3 00
Collet Blanks		1 60

### No. 21 Feeding Fingers.

Round:	1-8", 5-32", 3-16", 7-32", 1-4", 9-32", 5-16", 11-32", 3-8", 13-32", 7-16", 15-32", 1-2", 17-32", 9-16", 5-8"	1 75
Square:	1-4", 5-16", 3-8", 7-16"	2 50
Hexagonal:	1-4", 5-16", 3-8", 7-16", 1-2"	2 50
Metric, Round:	6 m/m to 16 m/m, varying by 1-2 m/m	1 75
Feeding Finger Blanks		85

List continued on next page.

Other sizes made to order.

# Spring Collets and Feeding Fingers (Cont.)

## No. 2 Wire Feed (Prior to Machine Serial No. 383.)

No. 12 Spring Collets.		Price Each.
Round:	1-4", 9-32", 5-16", 11-32", 3-8", 13-32", 7-16", 15-32", 1-2", 17-32", 9-16", 19-32", 5-8", 11-16", 3-4", 13-16", 7-8" . . .	\$3 50
Square:	3-8", 7-16", 1-2", 9-16" . . . . .	5 00
Hexagonal:	3-8", 7-16", 1-2", 9-16", 5-8", 11-16", 3-4" . . . . .	5 00
Metric, Round:	10 m/m to 20 m/m, varying by 1-2 m/m . . . . .	3 50
Collet Blanks	. . . . .	1 75

## No. 12 Feeding Fingers.

Round:	1-4", 9-32", 5-16", 11-32", 3-8", 13-32", 7-16", 15-32", 1-2", 17-32", 9-16", 19-32", 5-8", 11-16", 3-4", 13-16", 7-8" . . .	2 00
Square:	3-8", 7-16", 1-2", 9-16" . . . . .	2 75
Hexagonal:	3-8", 7-16", 1-2", 9-16", 5-8", 11-16", 3-4" . . . . .	2 75
Metric, Round:	10 m/m to 20 m/m, varying by 1-2 m/m . . . . .	2 00
Feeding Finger Blanks	. . . . .	1 00

## No. 2 and 2-G Automatic, also

### No. 2 Wire Feed (Commencing Machine Serial No. 383.)

## No. 22 Spring Collets.

Round:	1-8", 5-32", 3-16", 7-32", 1-4", 9-32", 5-16", 11-32", 3-8", 13-32", 7-16", 15-32", 1-2", 17-32", 9-16", 19-32", 5-8", 21-32", 11-16", 23-32", 3-4", 25-32", 13-16", 27-32", 7-8", 29-32", 15-16", 1" . . . . .	\$3 50
Square:	1-4", 5-16", 3-8", 7-16", 1-2", 9-16", 5-8", 11-16" . . . . .	5 00
Hexagonal:	1-4", 5-16", 3-8", 7-16", 1-2", 9-16", 5-8", 11-16", 3-4", 13-16", 7-8" . . . . .	5 00
Metric, Round:	10 m/m to 25 m/m, varying by 1 m/m . . . . .	3 50
Collet Blanks	. . . . .	1 75

## No. 22 Feeding Fingers.

Round:	1-8", 5-32", 3-16", 7-32", 1-4", 9-32", 5-16", 11-32", 3-8", 13-32", 7-16", 15-32", 1-2", 17-32", 9-16", 19-32", 5-8", 21-32", 11-16", 23-32", 3-4", 25-32", 13-16", 27-32", 7-8", 29-32", 15-16", 1" . . . . .	2 00
Square:	1-4", 5-16", 3-8", 7-16", 1-2", 9-16", 5-8", 11-16" . . . . .	2 75
Hexagonal:	1-4", 5-16", 3-8", 7-16", 1-2", 9-16", 5-8", 11-16", 3-4", 13-16", 7-8" . . . . .	2 75
Metric, Round:	10 m/m to 25 m/m, varying by 1 m/m . . . . .	2 00
Feeding Finger Blanks	. . . . .	1 00

## No. 22B Spring Collets, for use with 1 1-8" Feed Tube.

Round:	1 1-16", 1 1-8" . . . . .	4 50
Hexagonal:	15-16" . . . . .	6 75
Metric, Round:	26, 27, 28 m/m . . . . .	4 50
Collet Blanks	. . . . .	2 75

List continued on next page.

Other sizes made to order.

## Spring Collets and Feeding Fingers (Cont.)

### Nos. 2 and 2G Automatic and No. 2 Wire Feed.

No. 22A Feeding Fingers, for 1 1-8" Feed Tube		Price Each.
Round: 1 1-16", 1 1-8" . . . . .		\$2 75
Hexagonal: 15-16" . . . . .		4 50
Metric, Round: 26, 27, 28 m/m . . . . .		2 75
Feeding Finger Blanks . . . . .		1 75

### No. 6 Automatic Screw Machine.

#### No. 26M Master Spring Collets.

Round or Hexagonal: Takes interchangeable sets of pads for any size round stock to and including 2" diameter, and any size hexagonal stock to and including 1 3-4" across flats . . .	\$10 00
Square: Takes interchangeable sets of pads for any size square stock to and including 1 11-16", across flats. . . . .	11 00

#### \*Pads For No. 26M Master Spring Collets.

Round: Any size to and including 2", set of three . . . . .	2 25
Hexagonal: Any size to and including 1 3-4", set of three . . . . .	3 50
Square: Any size to and including 1 11-16", set of four . . . . .	3 50

#### No. 26M Master Feeding Fingers.

Round or Hexagonal: Takes interchangeable sets of pads for any size round stock to and including 1 3-4" diameter, and any size hexagonal stock to and including 1 1-2" across flats . . . . .	7 75
Square: Takes interchangeable sets of pads for any size square stock to and including 1 7-16" across flats . . . . .	9 00

#### \*Pads For No. 26M Master Feeding Fingers.

Round: Any size to and including 1 3-4", set of three . . . . .	1 50
Hexagonal: Any size to and including 1 1-2", set of three . . . . .	2 25
Square: Any size to and including 1 7-16", set of four . . . . .	2 25

#### \*No. 26 Feeding Fingers (Regular Style).

Round: Any size from 1 13-16" to 2", inclusive . . . . .	7 75
Hexagonal: Any size from 1 9-16" to 1 3-4", inclusive . . . . .	10 00

#### Feed Tube Bushings.

Use in rear end of feed tube for steadying and supporting the bar.  
Round bushings used for round, square or hexagonal stock. In specifying size wanted, add 1-82" to diameter or distance across corners of stock.

*Any size to and including 2 13-32" diameter . . . . .	\$1 25 each.
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\*Made to order only.

# Spring Collets and Feeding Fingers.

For Use with Outside Feeding Attachment.

## Nos. 0 and 0G Automatic.

		Price Each.
<b>No. 11 Spring Collets.</b>		
Round:	9-16", 5-8", 11-16", 3-4", 13-16" . . . . .	\$2 75
Hexagonal:	1-2", 9-16", 5-8", 11-16" . . . . .	4 50
<b>Metric, Round:</b>	14 m/m to 20 m/m, varying by 1 m/m . . . . .	2 75
Collet Blanks . . . . .		1 50

## No. 11B Feeding Fingers.

Round:	9-16", 5-8", 11-16", 3-4", 13-16" . . . . .	4 50
Hexagonal:	1-2", 9-16", 5-8", 11-16" . . . . .	6 75
<b>Metric, Round:</b>	14 m/m to 20 m/m, varying by 1 m/m . . . . .	4 50
Feeding Finger Blanks . . . . .		2 25

## Nos. 2 and 2G Automatic.

### No. 22A Spring Collets, for Machines with 1 5-16" Hole in Spindle.

Round:	1 1-16", 1 1-8", 1 3-16", 1 1-4" . . . . .	\$4 50
Hexagonal:	1", 1 1-16", 1 1-8" . . . . .	6 75
Collet Blanks . . . . .		2 75

### No. 22B Spring Collets, for Machines with 1 7-16" Hole in Spindle.

Round:	1 1-16", 1 1-8", 1 3-16", 1 1-4", 1 5-16", 1 3-8" . . . . .	4 50
Hexagonal:	1", 1 1-16", 1 1-8", 1 3-16" . . . . .	6 75
<b>Metric, Round:</b>	26 m/m to 35 m/m, varying by 1 m/m . . . . .	4 50
Collet Blanks . . . . .		2 75

## No. 22B Feeding Fingers.

Round:	1 1-16", 1 1-8", 1 3-16", 1 1-4", 1 5-16", 1 3-8" . . . . .	5 00
Hexagonal:	1", 1 1-16", 1 1-8", 1 3-16" . . . . .	7 25
<b>Metric, Round:</b>	26 m/m to 35 m/m, varying by 1 m/m . . . . .	5 00
Feeding Finger Blanks . . . . .		3 50

## No. 6 Automatic Screw Machines.

### \*No. 26 Spring Collets.

Round:	Any size from 2 1-16" to 2 3-8", inclusive . . . . .	\$10 00
Hexagonal:	Any size from 1 13-16" to 2", inclusive . . . . .	12 25

### \*No. 26MB Master Feeding Fingers.

Round:	Takes interchangeable sets of pads for any size round stock from 2 1-16" to 2 3-8", inclusive . . . . .	11 00
Hexagonal:	Takes interchangeable sets of pads for any size hexagonal stock from 1 13-16" to 2" inclusive . . . . .	11 00
Square:	Takes interchangeable sets of pads for any size square stock from 1 1-2" to 1 11-16", inclusive . . . . .	11 00

### \*Pads For No. 26MB Master Feeding Fingers.

Round:	Any size from 2 1-16" to 2 3-8", inclusive, set of four . . . . .	1 75
Hexagonal:	Any size from 1 13-16" to 2", inclusive, set of four . . . . .	2 75
Square:	Any size from 1 1-2" to 1 11-16", inclusive, set of four . . . . .	2 75

\*Made to order only.

## Extra Size Feed Tubes and Fingers.

### For Wire Feed and Automatic Screw Machines.

These feed tubes and fingers are somewhat lighter in construction than those regularly furnished with the machines. As they allow stock to be used of larger diameter than the rated capacity of the machines, they are offered for use only on brass or other work requiring comparatively light cuts.

Be sure to specify serial number of machine when ordering.

No. of Machine.	Machine Serial No.	Largest Diameter of Stock.			Fingers How Attached.	Price Tube without Finger.	Price Tube with Round Finger.
Wire Feed		Round	Hex.-Flats	Square			
0	96 to 371	$\frac{17}{16}$ "	$\frac{23}{16}$ "	$\frac{3}{8}$ "	One Piece		\$11 00
	96 to 371	$\frac{1}{2}$ "	$\frac{7}{16}$ "	$\frac{23}{64}$ "	Soldered	\$6 75	8 50
	begin 372	$\frac{1}{2}$ "	$\frac{7}{16}$ "	$\frac{23}{64}$ "	Threaded	9 25	11 00
1	prior to 227	$\frac{1}{2}$ "	$\frac{7}{16}$ "	$\frac{1}{2}$ "	Soldered	6 75	8 50
	prior to 227	$\frac{1}{8}$ "	$\frac{1}{2}$ "	$\frac{1}{2}$ "	One Piece		11 00
	227 to 495	$\frac{3}{4}$ "	$\frac{3}{4}$ "	$\frac{1}{2}$ "	Soldered	7 75	9 50
2	begin 496	$\frac{3}{4}$ "	$\frac{3}{4}$ "	$\frac{1}{2}$ "	Threaded	10 50	12 25
	prior to 383	1"	$\frac{7}{8}$ "	$\frac{1}{2}$ "	Soldered	14 50	16 50
	383 to 863	$1\frac{1}{8}$ "	$\frac{1}{2}$ "	$\frac{1}{2}$ "	Soldered	14 50	16 50
	begin 864	$1\frac{1}{8}$ "	$\frac{3}{4}$ "	$\frac{3}{4}$ "	Threaded*	20 00	22 50
Automatic							
00	prior to 3448	$\frac{3}{8}$ "	$\frac{21}{64}$ "	$\frac{1}{4}$ "	Soldered	5 50	6 75
00G	prior to 3098						
00	begin 3448	$\frac{3}{8}$ "	$\frac{21}{64}$ "	$\frac{1}{4}$ "	Threaded	5 50	6 75
00G	begin 3098						
0	prior to 2015	$\frac{9}{16}$ "	$\frac{1}{2}$ "	$\frac{1}{32}$ "	Soldered	6 75	8 50
0G	prior to 2215						
0	prior to 2015	$\frac{5}{8}$ "	$\frac{1}{2}$ "	$\frac{29}{64}$ "	One Piece		11 00
0G	prior to 2215						
0	begin 2015	$\frac{5}{8}$ "	$\frac{1}{2}$ "	$\frac{29}{64}$ "	Threaded	6 75	8 50
0G	begin 2215						
1		$\frac{1}{4}$ "	$\frac{39}{64}$ "	$\frac{1}{2}$ "	Soldered	9 00	10 75
1		$\frac{3}{4}$ "	$\frac{31}{32}$ "	$\frac{3}{4}$ "	One Piece		13 25
2	prior to 2255	$1\frac{1}{8}$ "	$\frac{1}{2}$ "	$\frac{3}{4}$ "	Soldered	14 50	16 50
2G	prior to 2205						
2	begin 2255	$1\frac{1}{8}$ "	$\frac{1}{2}$ "	$\frac{25}{32}$ "	Threaded*	20 00	22 50
2G	begin 2205						

\*Special chuck nut and chuck sleeve are included with the feed tube.

## Extra Capacity Collets.

We can furnish extra capacity collets and chucks for second operation work larger than rated bar capacity on Plain, Wire Feed and Automatic Screw Machines. These are automatically operated and have no end movement on the work. Largest diameter taken: No. 0 Wire Feed, 1 3-4"; No. 1 Wire Feed, 2 1-2"; Nos. 2 Wire Feed, 2 & 2G Automatic, 3"; Nos. 00 & 00G Automatic, 1 3-8"; Nos. 0 and 0G Automatic, 2"; No. 6 Automatic, 5"; Nos. 4 Plain & 4 Wire Feed, 6"; Nos. 6 Plain & 6 Wire Feed, 7". Equipment: Collet blank, sleeve and holding rod; for two latter capacities chuck and holding rod. Prices on application.



# Circular Cutting-Off and Forming Tool Blanks

## For Use on Automatic Screw Machines.

Blanks for Cutting-Off and Forming Tools are made of either Carbon or High Speed Steel. They are turned to size and drilled and tapped for clamping screw. Specify thickness when ordering.

No. of Machine where used.	Diameter.	Thickness.	Price, Carbon Steel.	Price, High Speed Steel.
00, 00G & 19 Auto.	1 3-4"	1-4" to 1-2" by 16ths	\$0 50	\$0 85
00, 00G & 19 Auto.	1 3-4	9-16 to 1 by 16ths	70	1 40
0 & 0G Automatic	2 1-4	1-4 to 5-8 by 16ths	70	1 40
0 & 0G Automatic	2 1-4	11-16 to 1 1-8 by 16ths	1 00	2 00
1 Automatic	2 1-2	3-8 to 7-8 by 16ths	1 10	..
1 Automatic	2 1-2	15-16 to 1 1-4 by 16ths	1 65	..
2 & 2G Automatic	3	3-8 to 13-16 by 16ths	1 10	2 20
2 & 2G Automatic	3	7-8 to 1 1-4 by 16ths	1 65	3 30
*6 Automatic	4	1-2, 5-8, 3-4, 7-8	3 50	..
*6 Automatic	4	1, 1 1-4, 1 1-2	4 25	..
*6 Automatic	4	1 3-4, 2	5 25	..
*6 Automatic	4	2 1-4, 2 1-2	6 75	..
*6 Automatic	4	2 3-4	7 75	..

\* Made to order only.

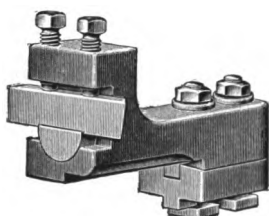
## Cam Blanks.

Cam Blanks are put up in sets of three. They are made of mild steel and all except those for the No. 6 machine are bored and turned and divided into 100 parts to assist in laying out the cam. Cam Blanks for No. 6 Automatic are provided with necessary holes, but are left square and are not graduated.

For Nos. 00, 00G and 19 Automatic Screw Machines . . . Set of three . . . \$1 25  
 For Nos. 0 and 0G Automatic Screw Machines . . . . . Set of three . . . 1 75  
 For No. 1 Automatic Screw Machine . . . . . Set of three . . . 2 75  
 For Nos. 2 and 2G Automatic Screw Machines . . . . . Set of three . . . 2 75  
 For No. 6 Automatic Screw Machine . . . . . Set of three . . . 6 75  
 For No. 6 Automatic Screw Machine, cross slide cam blanks . . each . . . 1 75  
 For No. 6 Automatic Screw Machine, turret slide cam blanks . each . . . 3 50

## Turret Tool Posts.

### For No. 6 Automatic Screw Machine.



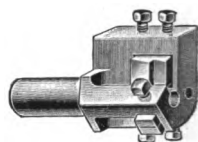
No. 26A Turret Tool Post (short style) and No. 26B Turret Tool Post (long style) are used either together or singly for turning operations. The raising block with each allows post to be used with spindle running in either direction. They will turn to capacity of machine. Other tools can often be used at same time in advance or in rear of these posts.

Prices. No. 26A, \$10 00; No. 26B, \$16 50.

## Box Tools (Style 1).

### For Use on Screw Machines.

Nos. 00B, 00C and 20C are equipped with one blade; all the others have two blades. Nos. 00C, 20, 20A, 20B, 20C and 22B are arranged to hold a centre drill or pointing tool in the shank, clamped in position by a set screw. A centre drill is furnished with the No. 00C. The back rests are beveled on both ends to increase their capacity, one end being for work of small diameter and the other for large work. Plain V rests are used on this style. One set of blades and back rests are furnished.



No.	No. of Machine where used.	Diameter that can be turned	Length that can be turned	Length of Body.	Diameter of Shank.	Length of Shank.	Price.
*00	00, 00G & 19 Auto.	1-4"	1 1-4"	{ 1 3-8"	5-8"	1 1-8"	\$9 00
†00A	00, 00G & 19 Auto.	1-4	1 1-4	1 3-8	5-8	1 3-8	9 00
00B	00, 00G & 19 Auto.	3-16	1 1-4	3-4	5-8	1 3-4	5 00
†00C	00, 00G & 19 Auto.	1-4	5-8	1 3-8	5-8	1 1-8	9 50
20	0 & 0G Automatic	1-2	1 5-8	2 3-16	3-4	1 1-2	11 00
†20A	0 & 0G Automatic	1-2	1 5-8	2 3-16	3-4	1 1-2	13 50
20B	0 & 0G Automatic	1-4	2	2 3-16	3-4	1 1-2	10 00
20C	0 & 0G Automatic	1-2	3-4	1 1-4	3-4	1 1-2	11 00
22B	2 & 2G Automatic	5-8	2	2 5-8	1	1 3-4	15 50

\*Specify length of shank wanted.

† With Centre Drill.

‡ Left Hand.

## Box Tools (Style 2).

### For Use on Screw Machines.

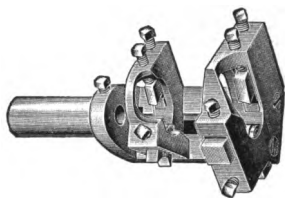
No. 22 Box Tool has plain V back rests. All others of this style have roller back rests for the front blades and plain V rests for the rear. The rollers materially reduce the friction on heavy cuts and are adjustable for different diameters. Plain rests are beveled on both ends to increase their range.

The rear tool holder is adjustable along the body of the box tool, allowing for different distances between the front and rear blades.

No. 22 has two adjustable and one fixed tool holders.

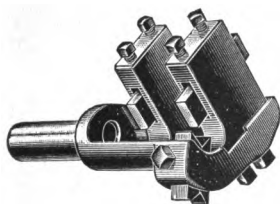
Nos. 12 and 22 are arranged to hold a centre drill or pointing tool in the shank, clamped in position by a set screw. The drill is not included in price of tool.

One set of blades and back rests are furnished.



No.	No. of Machine where used.	Diameter that can be turned.	Length that can be turned.	Length of Body.	Diam. of Shank.	Length of Shank.	Price.
22	2 & 2G Automatic	7-8"	2 3-8"	3"	1"	2"	\$20 00
12	2 W.F.; 2 Plain	1	3 1-2	4 1-8	1	2 1-2	20 00
14	{ 4 Plain 428 to 601* 4 W.F. prior to 23* }	1 1-4	4 1-2	5 1-4	1 1-2	3 1-4	28 50
34	{ 4 Plain; 4 W.F. 5 Plain }	1 1-4 1 1-8	4 1-2 8	5 1-4	1 3-4	3 1-4	28 50
16	{ 5 Plain 428 to 581* 6 Plain 59 to 230* }	1 1-2	5	5 5-8	1 1-2	3 1-4	33 00
36	6 Plain; 6 W.F.	{ 1 1-2 1 3-8 }	{ 5 10 }	5 1-2	2	3 1-4	33 00

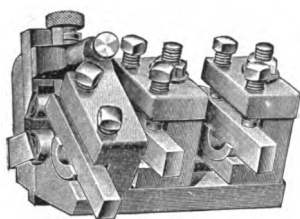
## Box Tools (Style 3).



The front tool holder is fixed in position; the rear tool holder is adjustable along the body of the tool, allowing for different distances between the blades. The holders are made narrow to allow the tools to be set close together when desired. The back rest is beveled on both ends, one end being used for large and one for small diameters. One set of blades and back rests are furnished.

No.	No. of Machine where used.	Diameter that can be turned.	Length that can be turned.	Length of Body.	Diam. of Shank.	Length of Shank.	Price.
20D	0 & 0G Automatic	3-8"	2"	2 3-16"	3-4"	1 1-2"	\$15 50
21	1 Automatic	1-2	2	2 5-8	1	1 3-4	15 50
10	0 Wire Feed	3-8	1 3-4	2 3-16	5-8	1 7-16	15 50
11	1 W.F.; 1 Plain	1-2	2 1-4	2 11-16	3-4	2	15 50
13		1	3	3 3-4	1 1-4	3 1-4	24 50

\* Be sure to give serial numbers of machines.



## Box Tools

For No. 6

### Automatic Screw Machine.

No. 26 Box Tool has three tools and will turn three diameters at once. Two rear tool posts are adjustable along body. Roller back rest in front, plain V rest between rear blades. Turning capacity to 1 3/4" diameter.

Price, \$45 00.

## Drill Holders

### For Use on Screw Machines.

One blank bushing furnished with each holder. Bushings listed below.



No.	No. of Machine where used.	Diam. of Hole for Drill or Bushing.	Depth of Hole.	Length of Body.	Diameter of Shank.	Length of Shank.	Price.
00	00 & 00G Auto.	5 Taper	5-8"	7-8"	5-8"	1 1-8"	\$2 00
00A	00 & 00G Auto.	1-2"	11-16	7-8	5-8	1 1-8	2 25
10	0 Wire Feed	1-2	11-16	1	5-8	1 7-16	2 25
11	1 W.F. & 1 Plain	5-8	13-16	1 1-8	3-4	2	2 25
12	2 W.F. & 2 Plain	1	1 3-16	1 5-8	1	2 1-2	3 50
14	4 Pln. 428 to 601*	1	1 3-16	1 7-8	1 1-2	3 1-4	4 00
16	4 W.F. prior to 23*						
16	5 Pln. 428 to 581*						
16	6 Plain 59 to 230*	1 1-2	1 5-8	2 1-4	1 1-2	3 1-4	4 50
20	0 & 0G Automatic	5-8	13-16	1	3-4	1 1-2	2 25
21	1 Automatic	3-4	15-16	1 1-4	1	1 3-4	2 75
22	2 & 2G Automatic	1	1 3-16	1 7-16	1	1 3-4	3 50
34	4 Plain & 4 W.F.	1 1-2	1 5-8	2 1-4	1 3-4	3	4 50
36	6 Plain & 6 W.F.	1 1-2	1 5-8	2 1-4	2	3 1-4	4 50

\* Be sure to give serial numbers of machines.

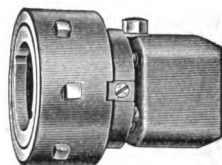
## Bushings and Bushing Blanks.

No.	No. of Drill, Tap or Floating Holders where used.	Outside Diameter.	Length.	Price, Finished Bushing.	Price, Bushing Blank.
00	00	5 Taper	11-16"	\$1 25	\$0 30
00A	00A (Tap Holder)	1 4"	7-16	1 25	30
10	00A, 00C, 10	1-2	3-4	1 25	30
00B	00B	1-2	9-16	1 25	30
11	11, 20, 20B	5-8	7-8	1 25	30
21	21	3-4	1	1 25	35
12	12, 13, 14, 22, 22B	1	1 1-4	1 25	35
16	16, 34, 36	1 1-2	1 3-4	1 75	50

## Die Holder.

### For No. 6 Automatic Screw Machine.

**No. 26 Die Holder** is of the plain, draw-out type. Three caps, having inside diameters of 2", 2 1-2" and 3", are furnished. It will thread work to 1 7-16" diameter. Stock sizes Carpenter's dies used—5-8" x 2", 11-16" x 2 1-2", 1 1-16" x 3".



Price, without dies, \$22 00.

## Opening Die Holders.

### For Use on Automatic Screw Machines.

The use of these Die Holders obviates the necessity of reversing the spindle to back the die off threaded work. They are especially useful for threading operations when only one spindle pulley is available for driving, or on machines not arranged to reverse. All sizes of these Die Holders carry four chasers.

No.	No. of Machine where used.	Capacity.	Price with one set of chasers.
00	00 & 00G Automatic	11-32"	\$28 00
20	0 & 0G Automatic	15-32	33 00
22	2 & 2G Automatic	5-8	44 00

## Closers for Opening Die Holders.

The Die Closer is attached to a finished pad on the front of the Automatic Screw Machine, provided for the purpose. It can then be adjusted to engage the pin on the Opening Die Holder and close the die as the turret is rotated after the threading operation.

No. 20 for use on Nos. 0 and 0G Automatic Screw Machines . . . \$6 00

No. 22 for use on Nos. 2 and 2G Automatic Screw Machines . . . 7 00

# Tap Holders for Use on Screw Machines.



The Tap Holders in the accompanying table marked "releasing" are for any Screw Machine operated by hand and have an improved clutch mechanism which avoids the hard shock and jar usual with such tools when released. The parts subject to wear are small and easily renewed. All parts are hardened. One blank bushing is furnished.

Bushings listed, page 324.

No. of Holder.	No. of Machine where used.	Releasing.	Diameter of Hole for Tap or Bushing.	Depth of Hole to Receive Tap.	Length of Body.	Diameter of Shank.	Length of Shank.	Price.
00	00 & 00G Automatic	No	No. 5 Taper	5-8"	15-16"	5-8"	1 1-8"	\$4 50
00A	00 & 00G Automatic	No	1-4	3-8	15-16	5-8	1 1-8	3 50
00B	00 & 00G Automatic	Yes	1-2	1-2	1 1-16	5-8	1 1-8	5 00
00C	00 & 00G Automatic	No	1-2	11-16	15-16	5-8	1 1-8	4 50
10	0 Wire Feed	Yes	1-2	11-16	1 5-16	5-8	1 7-16	5 50
11	1 W.F. & 1 Plain	Yes	5-8	13-16	1 7-16	3-4	2	6 00
12	2 W.F. & 2 Plain	Yes	1	1 3-16	2	1	2 1-2	7 75
13		Yes	1	1 3-16	2 1-2	1 1-4	3 1-4	11 00
14	4 Plain 428 to 601*	Yes	1	1 3-16	2 1-2	1 1-2	3 1-4	11 00
16	4 W.F. prior to 23* 5 Plain 428 to 581* 6 Plain 59 to 230*	Yes	1 1-2	1 5-8	2 7-8	1 1-2	3 1-4	16 50
20	0 & 0G Automatic	No	5-8	13-16	1 7-16	3-4	1 1-2	5 00
20B	0 & 0G Automatic	Yes	5-8	13-16	1 7-16	3-4	1 1-2	6 00
21	1 Automatic	No	3-4	15-16	1 1-2	1	1 3-4	5 50
22	2 & 2G Automatic	No	1	1 3-16	1 9-16	1	1 3-4	5 50
22B	2 & 2G Automatic	Yes	1	1 3-16	2	1	1 3-4	7 75
34	4 Plain & 4 W.F.	Yes	1 1-2	1 5-8	2 7-16	1 3-4	3	13 25
36	6 Plain & 6 W.F.	Yes	1 1-2	1 5-8	2 7-8	2	3 1-4	16 50

\* Be sure to give serial numbers of machines.

# Die Holders for Use on Screw Machines.

The Holders are either of plain, drawout style or releasing style. The latter have an improved clutch mechanism which prevents the usual hard shock on releasing. Parts subject to wear are hardened.

Extra capacity die caps and bushings can be furnished to take larger dies on following holders: for Nos. 11, 20 and 20B, takes die 1-2" x 1 1-2"—\$3 00; for Nos. 12, 22 and 22B, takes die 5-8" x 2"—\$4 00.



No. of Holder.	No. of Machine where used.	Releasing.	Capacity.		Length of Body.	Diam. of Shank.	Length of Shank.	Dies Used. Carpenter's Stock Sizes.	Price.
			Dia. Thd.	Lth. Thd.					
00B	00 & 00G Auto.	Yes	1-4"	3-4"	1 7-16"	5-8"	1 1-8"	1-4" x 5-8"	\$5 50
00E	00 & 00G Auto.	No	5-16	1	1 3-8	5-8	1 1-4	1-4 x 5-8	5 50
10	0 Wire Feed	Yes	9-32	1	1 11-16	5-8	1 7-16	1-4 x 5-8	5 50
11	1 W.F. & 1 Plain	Yes	3-8	1	1 13-16	3-4	2	1-4 x 13-16	6 75
12	2 W.F. & 2 Plain	Yes	1-2	2 3-8	2 3-8	1	2 1-2	5-16 x 1	9 00
13		Yes	3-4	2 1-2	3 1-4	1 1-4	3 1-4	1-2 x 1 1-2	16 50
14	4 Plain 428 to 601*	Yes	3-4	2 1-2	3 1-4	1 1-2	3 1-4	1-2 x 1 1-2	17 50
15	4 W.F. prior to 23*								
16	5 Plain 428 to 581*								
	6 Plain 59 to 230*	Yes	1 1-16	2 3-4	3 5-8	1 1-2	3 1-4	11-16 x 2 1-2	22 00
20	0 & 0G Automatic	No	3-8	1 1-4	1 3-4	3-4	1 3-4	1-4 x 13-16	5 50
20B	0 & 0G Automatic	Yes	3-8	1	1 13-16	3-4	1 1-2	1-4 x 13-16	6 75
21	1 Automatic	No	3-8	2	2 5-8	1	1 3-4	1-4 x 13-16	7 75
22	2 & 2G Automatic	No	1-2	1 3-4	2 3-8	1	1 3-4	5-16 x 1	6 75
22B	2 & 2G Automatic	Yes	1-2	2 3-8	2 3-8	1	1 3-4	5-16 x 1	9 00
34	4 & 5 Plain; 4 W.F.	Yes	+1	+2 3-4	3 5-8	1 3-4	3	5-8 x 2	22 00
36	6 Plain; 6 W.F.	Yes	+1 1-2	+3 1-8	4	2	3 1-4	5-8 x 2	28 50
								{ 11-16 x 2 1-2 1 1-16 x 3 }	

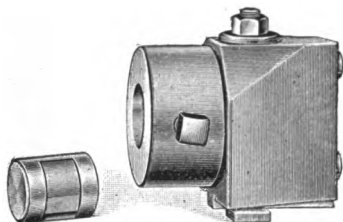
\* Be sure to give serial numbers of machines.

+ 13-16—8 long.

+ 1 1-16—10 long.

## Tap Holder

### For No. 6 Automatic Screw Machine.



No. 26 Tap Holder is of plain drawout style, holding the tap in a bushing, one blank bushing being furnished. Size of hole for tap or bushing, 1 1-2" diameter, 1 5-8" deep.

**Price, \$11 00.**

**Finished Bushing, \$1 75.**

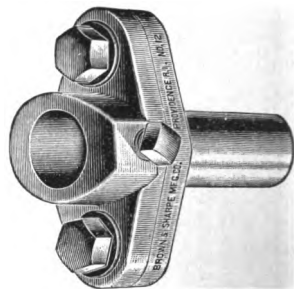
**Blanks, \$0 50 each.**

## Floating Holders

### For Use on Screw Machines.

**For Holding Drills, Reamers, Counterbores, Etc., in the Turret.**

The holder and shank are separate and after a tool is adjusted central with the work, the two are clamped together. One blank bushing is furnished. Bushings listed, page 324.



No.	No. of Machine where used.	Diam. of Hole for Drill or Bushing.	Depth of Hole.	Length of Body.	Diameter of Shank.	Length of Shank.	Price.
00	00, 00G & 19 Auto.	5 Taper	5-8"	15-16"	5-8"	1 1-8"	\$3 50
00A	00, 00G & 19 Auto.	1-2"	11-16	27-32	5-8	1 1-8	3 50
10	0 Wire Feed	1-2	11-16	29-32	5-8	1 7-16	3 50
11	1 W.F. & 1 Plain	5-8	13-16	1 1-8	3-4	2	4 00
12	2 W.F. & 2 Plain	1	1 3-16	1 1-2	1	2 1-2	4 50
14	4 Plain 428 to 601*	1 1-2	1 3-16	1 9-16	1 1-2	3 1-4	5 00
16	4 W.F. prior to 23*		1 5-8	2 5-32	1 1-2	3 1-4	6 75
	6 Plain 59 to 230*						
20	0 & 0G Automatic	5-8	13-16	1 1-8	3-4	2	4 00
21	1 Automatic	3-4	15-16	1 1-4	1	2 1-2	5 50
22	2 & 2G Automatic	1	1 3-16	1 1-2	1	1 3-4	4 50
34	4 Plain & 4 W.F.	1 1-2	1 5-8	2 5-32	1 3-4	3	6 00
36	6 Plain & 6 W.F.	1 1-2	1 5-8	2 5-32	2	3 1-4	6 75

\* Be sure to give serial number of machines.



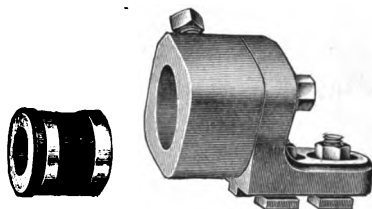
## Floating Holder.

### For No. 6 Automatic Screw Machine.

**No. 26 Floating Holder** holds drills, reamers, etc., which can be set central with work and then the floating head clamped. A bushing blank is furnished.

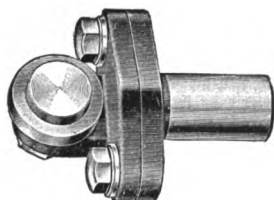
Diameter of hole for bushing, 2".

Price, \$9 00. Finished Bushing, \$2 00. Blanks, \$0 70 each.



## Pointing Tool Holders.

### For Circular Tools.



For use in the turret of Automatic Screw Machines for pointing or forming the end of the work. The circular tool may be readily removed and ground without changing its form.

The holder and shank are separate, and after the tool is adjusted central with the work the two are clamped together. One tool blank is furnished with holder.

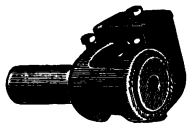
No.	No. of Machine where used.	Length Body.	Length Shank.	Diameter Shank.	Diameter Tool Blank.	Price.
00A	00, 00G & 19 Auto.	1 3-8"	1 1-8"	5-8"	1 1-8"	\$9 00
20A	0 & 0G Auto.	1 9-16	1 11-16	3-4	1 3-8	11 00
22A	2 & 2G Auto.	1 15-16	1 3-4	1	1 3-4	15 50

## Circular Pointing Tool Blanks.

For use with the Holder shown above. Carbon Steel. Price of blanks for use on Nos. 00, 00G and 19 Automatic, \$0 30; for use on Nos. 0 and 0G Automatic, \$0 30; for use on Nos. 2 and 2G Automatic, \$0 40.

## Pointing Tools (Style 1).

### For Use on Screw Machines.



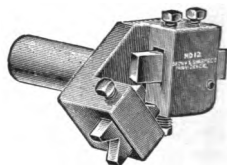
Pointing Tools of all styles are provided with a bushing or a plain V rest which precedes the blade to support the work. The blades are adjustable.

Style 1 is provided with 1 Blade and Blank Bushing.

No.	No. of Machine where used.	Capacity.	Length of Body.	Distance front of Bushing to Tool.	Diam. of Shank.	Length of Shank.	Price.
00B	00, 00G & 19 Auto.	3-16"	11-16"	3-16"	5-8"	1 13-16"	\$5 50
00C	00, 00G & 19 Auto.	1-4	1 3-16	5-16	5-8	1 5-16	6 00
20B	0 & 0G Automatic	1-2	1 1-2	3-8	3-4	1 3-4	10 00
22B	2 & 2G Automatic	7-8	1 7-8	1-2	1	2 1-2	13 50

## Pointing Tools (Style 2).

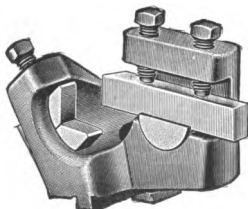
This style of Pointing Tool is provided with 1 Blade and Back Rest.



No.	No. of Machine where used.	Capacity.	Length of Body.	Distance front of Rest to Tool.	Diam. of Shank.	Length of Shank.	Price.
12	2 W. F. ; 2 Plain	1-4" to 3-4"	1 13-16"	3-8"	1"	2 1-2"	\$13 50
34	4 Plain; 4 W. F.	1-4 to 1 1-4	2 3-4	1-2	1 3-4	3	19 00
36	6 Plain; 6 W. F.	1-2 to 1 1-2	2 15-16	5-8	2	3 1-4	24 50

## Pointing Tool.

### For No. 6 Automatic Screw Machine.



No. 26 Pointing Tool is provided with 1 Blade and 1 V Back Rest preceding the tool. Points work to 1 1-2" diameter. Distance from front of Back Rest to Tool Blade, 9-16".

Price, \$28 00.

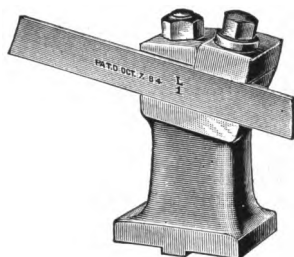
## Cutting-Off Tool Posts For Thin Blade Tools.

**For Use on the Cross Slides of Screw Machines.**

High back and low front are used when spindle runs forward.

Low back is used when spindle runs backward.

One blade is furnished with tool post.



No.	Style.	No. of Machine where used.	Top of Cross Slide to Centre of Spindle.	Price.
00	High back, low bk, low frt.	00 & 00G Auto.	1"	\$4 50
10	High back . . . . .	0 Wire Feed	1 9-16	6 00
11	High back . . . . .	1 W.F. & 1 Plain	2 1-16	6 75
12	High back . . . . .	2 W.F. & 2 Plain	2 1-2	7 25
		4 W.F. prior to 23*		
		4 Pln. prior to 602*		
		5 Pln. prior to 553*		
16	High back . . . . .	6 Plain 8 to 230*	2 15-16	7 75
20	High back, low bk, low frt.	0 & 0G Automatic	1 5-16	5 50
21	High back and low back	1 Automatic	1 7-16	7 75
22	High back, low bk, low frt.	2 & 2G Automatic	1 7-16	7 75

\* Be sure to give serial numbers of Machines.

## Blades for Cutting-Off Tool Posts.

For Post No.	Thickness.	Width.	Price Each, Carbon Steel.
00	1-32", 1-16", 5-64", 3-32" . . . . .	1-2"	\$0 50
10	1-16", 3-32", 1-8" . . . . .	11-16	50
11, 12 & 16	1-16", 3-32", 1-8" . . . . .	13-16	40
	5-32" . . . . .		45
	3-16" . . . . .		50
20, 21 & 22	1-16", 3-32", 1-8" . . . . .	11-16	50
*26	3-16" . . . . .	1	60

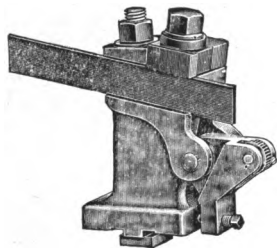
\* Post furnished with No. 6 Automatic Screw Machine.

## Stock Stops for Screw Machine Turret.

The stops are finished tapered on one end and are hardened.

For Nos. 00 and 00G Automatic Screw Machines . . . . .	\$0 30
For Nos. 0 and 0G Automatic Screw Machines . . . . .	30
For No. 1 Automatic Screw Machine . . . . .	35
For Nos. 2 and 2G Automatic Screw Machines . . . . .	35

## Combination Cutting-Off and Knurling Tool Posts.



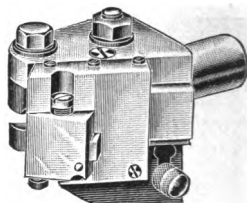
These posts are used on the back cross slide of Plain and Wire Feed Screw Machines for cross knurling and cutting-off. The knurl passes under the work and the spindle must be running forward. One blade and straight knurl is furnished.

No.	Machine where used.	Top of Cross Slide to Centre of Spindle.	Price.
10	No. 0 Wire Feed	1 9-16"	\$11 00
11	No. 1 Wire Feed	2 1-16	11 50
12	{ No. 2 W. F. and 2 Plain } { No. 4 Plain prior to 602* } { No. 5 Plain prior to 553* }	2 1-2	12 00

For Blades see list page 331. \*Be sure to give serial numbers of machines.

## Angular Cutting-Off Tools For Automatic Screw Machines.

The Angular Cutting-Off Tool is held in the turret and operated by either a Fixed or Adjustable Guide on the front cross slide. It is used when it is desired to form the end of the work cone shaped and to produce a clean cut sharp point when cut off. It is adjustable for any included angle within its capacity.

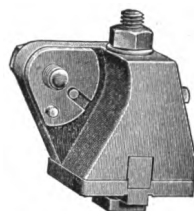


No.	No. of Machine where used.	Total Included Angle.	Diameter of Shank.	Length of Shank.	Length of Body.	Price.
00	00, 00G & 19 Auto.	50° to 80°	5-8"	1 1-8"	2"	\$40 00
20	0 & 0G Auto.	50° to 80°	3-4	1 3-8	2 5-8	55 00
22	2 & 2G Auto.	50° to 80°	1	1 3-4	3 3-16	72 00

Price does not include Fixed or Adjustable Guide.

## Tool Posts for Circular Tools.

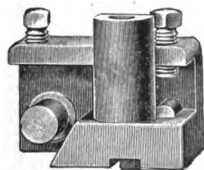
For holding circular form tools on Plain and Wire Feed Screw Machines. They are provided with tool adjustment, also a raising block so they may be used with the spindle running in either direction. In ordering, be sure to state whether to be used on front or back slide.



No.	No. of Machine where used.	Maximum Diameter of Tools.	Maximum Width of Tools.	Top of Cross Slide to Centre of Spindle.	Price Each.
10 Front } 10 Back }	0 Wire Feed	1 3-4"	3-4"	1 9-16"	\$13 50
11 Front } 11 Back }	1 Wire Feed	2 1-4	1 1-4	2 1-16	14 50
12 Front } 12 Back }	{ 2 W. F. and 2 Plain } 4 Plain prior to 602* 5 Plain prior to 553*	3	1 3-4	2 1-2	15 50

\* Be sure to give serial numbers of machines.

Circular Form Tool Blanks for above posts made to order.

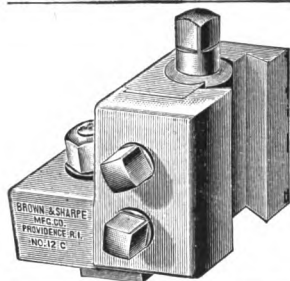


## Tool Posts for Square Tools

**For Holding Square Tools on Automatic  
Screw Machines.**

Means are provided for vertical adjustment of the tool.

No.	No. of Machine where used.	Top of Cross Slide to Centre of Spindle.	Size of Tools.		Price Each.
			Height.	Width.	
00 Front } 00 Back }	00, 00G & 19 Automatic	1"	7-16"	5-16"	\$10 00
20 Front } 20 Back }	0 & 0G Automatic	1 5-16	5-8	1-2	13 50
22 Front	2 & 2G Automatic	1 7-16	7-8	5-8	18 00
22 Back	2 & 2G Automatic	1 7-16	1-2	5-8	18 00



## Forming Tool Holders.

### For Use on Screw Machines.

Used on the front cross slides of Plain and Wire Feed Screw Machines for heavy forming cuts. The tool is adjusted vertically by means of a screw. It is clamped firmly in position after adjustment by the two cap screws on the side of the holder.

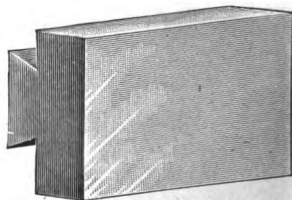
No.	No. of Machine where used.	Width of Tool.	Thickness of Tool.	Price.
10-A	No. 0 Wire Feed	1"	1-2	\$11 00
10-B	No. 0 Wire Feed	1 1-4	1-2	11 00
11-B	No. 1 W.F. & 1 Plain	1 1-4	9-16	13 50
11-C	No. 1 W.F. & 1 Plain	1 3-4	9-16	13 50
12-C	{ No. 2 W.F. & 2 Plain No. 4 Plain prior to 602* No. 4 W.F. prior to 23* No. 5 Plain prior to 553*	1 3-4	3-4	15 50
12-E		2 3-4	3-4	15 50
16-D		2 1-2	1	20 00
16-F	No. 6 Plain 59 to 231*	4	1	20 00
34-E	No. 4 Plain & 4 W.F.	2 3-4	1 1-4	23 00
36-F	No. 6 Plain & 6 W.F.	4	1	25 50

\*Be sure to give serial numbers of machines.

## Forming Tool Blanks.

### For Use in above Tool Holders.

The tool blanks are dovetailed to fit the holder and when required have a series of slots milled in the back to receive the collar of the adjusting screw.

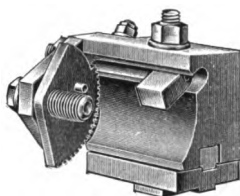


No.	Width.	Thickness.	Length.	Price, Carbon Steel.
10-A	1"	1-2"	1 1-2"	\$1 10
10-B	1 1-4	1-2	1 1-2	1 40
11-B	1 1-4	9-16	2	1 40
11-C	1 3-4	9-16	2	1 65
12-C	1 3-4	3-4	2 7-16	1 65
12-E	2 3-4	3-4	2 7-16	2 25
16-D	2 1-2	1	2 7-8	2 75
16-F	4	1	2 7-8	5 50
*34-E	{ 2 3-4 2 3-4	1 1-4	2 7-16	3 50
		1 1-4	2 7-8	3 50
36-F	4	1 1-2	3 5-16	6 00

\*Specify length wanted when ordering. For machines 3 1-2" from centre of spindle to top of cross slide use 2 7-16" length; for machines 3 15-16" centre of spindle to cross slide use 2 7-8" length.

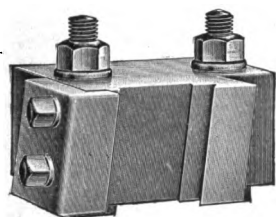
## Tool Post with Worm Adjustment.

For holding extra wide circular form tools on Automatic Screw Machines. Tool is adjusted and locked in position by worm and sector. Hook bolt for clamping tool. Raising block provides for setting tool with spindle running in either direction. Tool blanks made to order.



No.	Number of Machine where used.	Maximum Width of Tool.	Maximum Diameter of Tool.	Centre of Spindle to Top of Cross Slide.	Price Each.
20 Front	0 & 0G Auto.	1 3-4"	2 1-4"	1 5-16"	\$33 00
22 Front	2 & 2G Auto.	2 1-4	3	1 7-16	33 00
22 Back	2 & 2G Auto.	7-8	3	1 7-16	33 00

## Forming Tool Holder.



### For No. 6 Automatic Screw Machine.

No. 26F Forming Tool Holder is used on cross slide for heavy forming cuts. Takes tools 4" wide.

Tool blanks made to order.

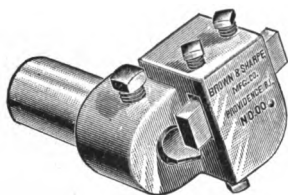
Price of Holder, \$16 50.

## Slotting Bushing Blanks.

The Bushing Blanks are for use in the transporting arm of the various Automatic Screw Machine attachments, for carrying the piece of work from the spindle to the attachment. The blanks are finished to fit the transporting arm, so that it is only necessary to recess to hold the piece of work and slot for the ejector. Prices, for Nos. 00 and 00G Automatic Screw Machines, \$0 25; for Nos. 0 and 0G Automatic Screw Machines, \$0 25; for Nos. 2 and 2G Automatic Screw Machines, \$0 30.

## Centering and Facing Tools

### For Use on Screw Machines.



The Centering and Facing Tool is used in the turret when the stock stop is dispensed with. It faces the stock to the required length and at the same time centres it to insure concentric drilling.

One blade and centering tool is furnished.

No.	No. of Machine where used.	Diameter of Drill.	Length of Body.	Diameter of Shank.	Length of Shank.	Price.
00	00, 00G & 19 Auto.	1-4"	1 3-8"	5-8"	1 3-8"	\$4 50
10	0 Wire Feed	5-16	1 9-16	5-8	1 7-16	7 75
11	{ 1 W.F.; 1 Plain 0 & 0G Automatic }	3-8	1 11-16	3-4	2	5 50
14	{ 4 Plain 428 to 601* 4 W.F. prior to 23* 5 Plain 428 to 581* 6 Plain 59 to 231* }	7-8	2 3-4	1 1-2	3 1-4	13 50
22	{ 2 W.F.; 2 Plain 1, 2 & 2G Auto. }	5-8	1 3-4	1	2 3-4	9 00
34	4 Plain; 4 W.F.	7-8	2 3-4	1 3-4	3	13 50
36	6 Plain; 6 W.F.	1 1-4	3	2	3 1-4	17 50

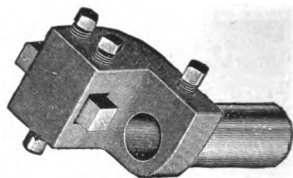
\* Be sure to give serial numbers of machines.

## Knee Tools

### For Automatic Screw Machines.

Knee Tools are used for simultaneous turning and internal cutting. The shank is arranged to hold a drill, counterbore or similar tool clamped by set screw.

One blade is furnished.



No.	No. of Machine where used.	Capacity.		Diam. of Shank.	Length of Shank.	Length of Body.	Price.
		Length.	Diameter up to.				
00	00, 00G & 19 Auto.	1 1-4"	3-8"	5-8"	1 1-8"	1 3-8"	\$9 00
20	0 & 0G Automatic	{ 2 1 3-8 }	{ 15-32 13-16 }	3-4	1 1-2	2 1-4	11 00
22	2 & 2G Automatic	{ 3 1 7-8 }	{ 21-32 1 3-8 }	1	1 3-4	3	13 50

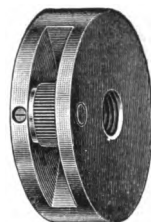


# Knurl Holders for Cross Slide

## For Automatic Screw Machines.

### Side Knurl Holders.

Side Knurl Holders are used on either front or back tool posts. They are held in place in same manner as circular form tools and do not permit the use of any other tool on the same post at the same time. They are used for thread rolling on brass in addition to knurling. One straight knurl is furnished.



No.	No. of Machine where used.	Diameter Holder.	Width Holder.	Width Knurl.	Price.
00A	00, 00G & 19 Auto.	1 3-4"	9-16"	3-16"	\$3 50
20A	0 & 0G Automatic	2 1-4	5-8	1-4	4 50
21A	1 Automatic	2 1-2	11-16	1-4	5 00
22A	2 & 2G Automatic	3	11-16	1-4	5 50

### Top Knurl Holders.

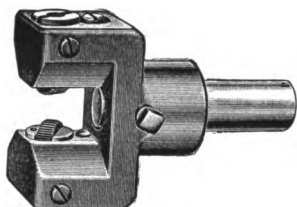


Top Knurl Holders are used on the rear tool post, the knurl passing over the work. They are held on a hub on the circular tool between the tool and post, both circular tool and knurl holder being clamped by one bolt. They are also used for thread rolling on brass, in which case the cutting off tool is mounted on the same tool post. One straight knurl is furnished.

No.	No. of Machine where used.	Capacity.	Width Knurl.	Price.
00B	00, 00G & 19 Automatic	3-8"	3-16"	\$7 75
20B	0 & 0G Automatic	5-8	1-4	9 00
21B	1 Automatic	3-4	1-4	11 00
22B	2 & 2G Automatic	1 1-8	1-4	11 00

## Adjustable Knurl Holders

### For Automatic Screw Machines.



The knurls are mounted in swivelling holders adjustable to any angle to produce straight, spiral or diamond knurls, using ordinary straight knurling rolls. The knurl holders have screw adjustment for setting to any diameter of work within the capacity of the tool. The shank is arranged to take a bush-

ing for holding end or internal cutting tools for operations to be combined with knurling. One pair of straight knurls is furnished.

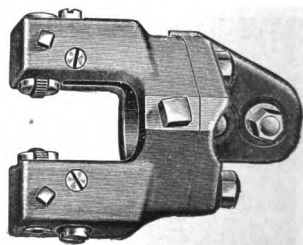
No.	No. of Machine where used.	Diameter of Shank.	Length of Shank.	Diameter will Knurl.	Length will Knurl.	Length of Body.	Price.
00	00, 00G & 19 Auto.	5-8"	1 1-8"	to 3-8"	1"	1 5-8"	\$13 50
20	0 & 0G Automatic	3-4	1 1-2	to 9-16	1 1-2	2 5-8	13 50
22	1, 2 & 2G Auto.	1	2 3-16	to 15-16 to 1 1-8	1 7-8 9-16	2 11-16	16 50

## Adjustable Knurl Holder

### For No. 6 Automatic Screw Machine.

**No. 26 Adjustable Knurl Holder** is similar in use to Knurl Holders described above. Will knurl to 2" diameter, 2 1-4" long or 1 7-8" diameter, 4 1-4" long. One pair of knurl blanks furnished. Diameter of hole in body for bushing, 2".

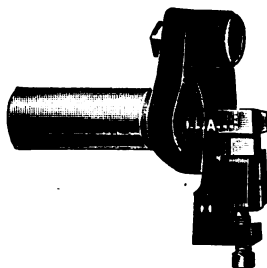
Price, \$20 00.



## Swing Tools

### For Automatic Screw Machines.

The Swing Tool is held in the turret and operated by either an Adjustable or Fixed Guide held under the front tool post. It is used for straight, taper or irregular turning where box tools or circular form tools are not applicable, as on long slender work of irregular shape or in turning behind shoulders. It is also used for cutting off when both cross slide tools are used for forming. The shank is arranged to hold a back rest for supporting work.



No.	No. of Machine where used.	Capacity.	Diam. of Shank.	Length of Shank.	Length of Body.	Price.
*00C	00, 00G & 19 Au.	$1\frac{1}{4}$ " long up to $\frac{3}{8}$ " dia. {	5-8"	1 3-16"	15-16"	\$19 00
			5-8	1 5-8	15-16	19 00
20C	0 & 0G Auto.	{ $1\frac{3}{8}$ " long up to $\frac{1}{2}$ " dia. {	3-4	1 5-8	1 7-16	20 00
		{ $\frac{7}{8}$ " long up to $\frac{3}{8}$ " dia. {				
20B	0 & 0G Auto.	{ $\frac{1}{2}$ " long up to $\frac{1}{4}$ " dia. {	3-4	2	1 3-4	20 00
		{ $1\frac{1}{8}$ " long up to $\frac{3}{8}$ " dia. {				
22C	2 & 2G Auto.	{ 3" long up to $\frac{3}{4}$ " dia. {	1	2	1 7-8	22 00
		{ $1\frac{1}{8}$ " long up to 1" dia. {				
22B	2 & 2G Auto.	{ 3" long up to $\frac{3}{4}$ " dia. {	1	2	2 17-32	24 00
		{ $1\frac{3}{4}$ " long up to 1" dia. }				

\* State length of shank desired when ordering.

Price does not include Fixed or Adjustable Guide.

## Recessing Swing Tools.

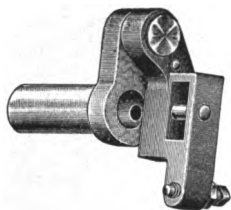
The Recessing Swing Tool is similar in design and operated in the same manner as the Swing Tool above, except it carries a round shank tool, parallel to shank of holder. It is used for chamfering and recessing internally.

No.	No. of Machine where used.	Swing from Centre.	Diameter of Shank.	Length of Shank.	Length of Body.	Price.
00H	00, 00G & 19 Auto.	3-16"	5-8"	1 3-8"	15-16"	\$20 00
20H	0 & 0G Automatic	1-4	3-4	1 3-4	1 1-4	22 00
22H	2 & 2G Automatic	9-32	1	2	2 1-4	24 00

Price does not include Fixed or Adjustable Guide.

## Knurling Swing Tools

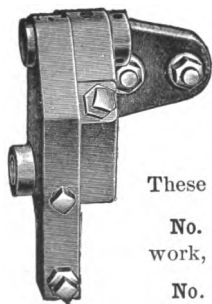
### For Automatic Screw Machines.



The Swing Knurl Holder is carried in the turret and is operated by either a Fixed or Adjustable Guide held under the front cross slide post. It carries a single knurl and is used for knurling behind shoulders of larger diameter or where knurled section is at some distance from the end of the piece. Also used for rolling threads on brass when the thread roll cannot be carried on the cross slide. Shank is arranged to take a back rest for supporting the work while knurling. One straight knurl is furnished.

No.	No. of Machine where used.	Capacity.	Diam. of Shank.	Length of Shank.	Length of Body.	Price.
00K	00, 00G & 19 Au.	{ 1 1/4" long up to 3/8" dia. 3/8" long up to 1/16" dia. }	5-8"	1 5-8"	1 3-16"	\$19 00
20K	0 & 0G Auto.	{ 2" long up to 1 1/8" dia. 7/8" long up to 1/16" dia. }	3-4	2	1 23-32	20 00
22K	2 & 2G Auto.	{ 3" long up to 2 1/4" dia. 1 1/4" long up to 1/16" dia. }	1	2 1-2	2 3-16	24 00

Price does not include either Fixed or Adjustable Guide.



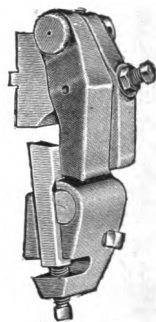
## Swing Tools

### For No. 6 Automatic Screw Machine.

These are used as described on preceding page.

No. 26 Swing Tool (at right) for external work, swings 7-8" from centre. Price, \$33 00.

No. 26H Recessing Swing Tool (at left) for internal work, swings 1-2" from centre. Size of hole for tool 3-4" x 1 1-2". Price, \$28 00.

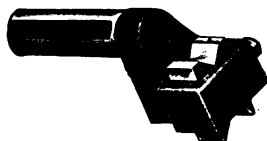


Fixed or Adjustable Guides for operating above are not included See page 342.

## Back Rests for Swing Tools.

### For Automatic Screw Machines.

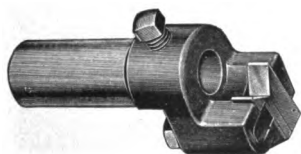
The Back Rest for Swing Tools is inserted in the hole in the shank of swing tool holders and is held in place by a set screw. The V back rests are usually set in advance of the turning tool. They are adjustable and are beveled on each end to allow for a range of diameters.



No.	No. of Machine where used.	Capacity.	Diameter Shank.	Length Shank.	Length Body.	Price.
00	00, 00G & 19 Auto.	1-4"	7-16"	1 7-16"	3-4"	\$5 50
20	0 & 0G Auto.	5-16	1-2	1 11-16	1	7 75
22	2 & 2G Auto.	1-2	11-16	2 1-4	1 7-16	10 00

## Back Rests for Turret.

### For Automatic Screw Machines.



The Back Rest for Turret is clamped in any of the turret holes and used for steadying the stock to prevent springing under heavy cross slide operations, as deep forming or side knurling on a slender piece. A set screw is provided for holding a stock stop or end cutting tool in the shank. The V supports are adjustable.

No.	No. of Machine where used.	Capacity.	Diameter Shank.	Length Shank.	Length Body.	Price.
00	00, 00G & 19 Auto.	3-8"	5-8"	1 3-4"	13-16"	\$5 00
00A	00, 00G & 19 Auto.	3-8	5-8	1 1-8	1 1-2	5 50
20	0 & 0G Auto.	5-8	3-4	1 3-4	1 5-8	7 75
22	1, 2 & 2G Auto.	1 1-8	1	2 3-8	1 3-4	11 00

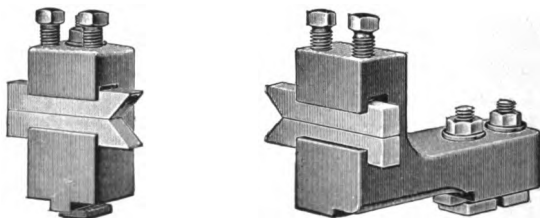
## Back Rest for Chuck.

This Back Rest clamps over the outside of the chuck guard on Nos. 00, 00G and 19 Automatic Screw Machines. It has a floating head carrying a bushing used for steadying small sizes of stock between the chuck and tools. Greatest distance between chuck and back rest, 1".

Price, \$16 50.

## Back Rests for Turret.

For No. 6 Automatic Screw Machine.



**No. 26A Back Rest** (short style) and **No. 26B Back Rest** (long style) are used in connection with Turret Tool Posts to prevent springing of small diameter bars under the cut. They are used on work to 1 3/8" diameter.

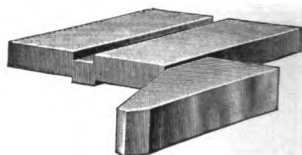
Price, No. 26A, \$11 00; No. 26B, \$16 50.

## Fixed and Adjustable Guides.

For No. 6 Automatic Screw Machine.

**No. 26A Fixed Guide** is used under front cross slide post for operating swing tools. Dimensions of guide for controlling swinging arm, 5 1/2" x 15-16".

Price, \$16 50.



**No. 26 Adjustable Guide**, used for taper turning with swing tools, has adjustment of guide toward or from line of spindle, also swing of guide through an included angle of

30°. Length of guide, 5 1/2".

Price, \$22 00.

## Fixed Guides

### For Automatic Screw Machines.

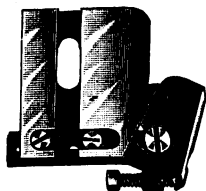


The Fixed Guide is held under the front tool post in place of the ordinary raising block used there. It is employed for operating Swing Tools for forming, recessing, knurling or thread rolling. The front face, which is parallel with the axis of the spindle, acts as a guide for controlling the motion of arm of the swing tool while cutting.

No.	No. of Machine where used.	Length.	Width.	Thickness.	Length Guide.	Price.
00A	00, 00G & 19 Auto.	2 13-16"	1 3-4"	1-4"	1 3-8"	\$4 50
20A	0 & 0G Automatic	3 15-16	2 1-2	5-16	1 3-4	5 50
22A	2 & 2G Automatic	4 13-16	3 3-8	1-2	2	7 75

## Adjustable Guides

### For Automatic Screw Machines.



The Adjustable Guide is held under the front tool post and is used in connection with swing and taper turning tools. The arm carrying the guide can be adjusted in and out. The guide has an angular adjustment with the line of the spindle.

No.	No. of Machine where used.	Width.	Thickness.	Length Guide.	Guide Swings Through Angle.	Price.
00	00, 00G & 19 Auto.	2 3-8"	1-4"	1 3-4"	30° incl.	\$5 50
20	0 & 0G Automatic	3 1-8	5-16	2 1-4	30° incl.	6 75
22	2 & 2G Automatic	3 9-16	1-2	2 1-2	30° incl.	9 00

## Spindle Brakes.

### For Automatic Screw Machines.

The Brake consists of a wide circular metal band lined with leather, and drawn together on the open side by a clamping screw. Means are provided for attaching to the machine frame.

It is used for stopping the spindle and holding it rigidly while cross drilling, milling, etc. It is applied to one of the spindle pulleys in place of the belt, except on the No. 2G, where it clamps over one of the sprocket wheels with a shoe engaging the sprocket wheel teeth.

No.	No. of Machine where used.	Width.	Outside Diameter.	Inside Diameter.	Price.
00	00 Automatic	1 1-4"	4 3-8"	4"	\$15 50
00G	00G Automatic	1 1-4	4 3-8	4	15 50
20	0 Automatic	2	6 7-16	6	19 00
20G	0G Automatic	2	6 7-16	6	19 00
22	2 Automatic	2 1-2	7 1-2	7	21 00
22G	2G Automatic	1 3-16	4 7-8	4 11-32	21 00

## Cam Templates.

Cam Templates consist of small forms of sheet celluloid, or German silver if preferred, with numerous standard curves cut in the periphery, to be used in laying out the rise and drop on cam lobes for Automatic Screw Machines. They are made in three sizes. Prices, for use with Nos. 00, 00G and 19 Automatic Screw Machines, \$1 75; Nos. 0 and 0G, \$2 25; Nos. 2 and 2G, \$2 25.

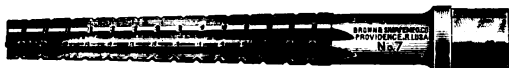
## Cam Lever Templates.

Cam Lever Templates are used for laying out Automatic Screw Machine cams in cases where very close timing is required, as for instance, when a tool is operated by the combined action of the cross slide and turret slide. They are made from sheet celluloid. Prices, for use with Nos. 00, 00G and 19 Automatic Screw Machines, \$2 25; Nos. 0 and 0G, \$2 25; Nos. 2 and 2G, \$2 75.



# Taper Reamers.

## Brown & Sharpe Standard.



**Roughing Reamer, Style 960-F.**



**Finishing Reamer, Style 961-F.**

### ROUGHING AND FINISHING.

No. of Taper.	Total Length.	Length of Flutes.	Price Each.
1	4 3-4"	2 7-8"	\$1 75
2	5 1-8	3 1-8	2 00
3	5 1-2	3 3-8	2 25
4	5 7-8	3 11-16	2 50
5	6 3-8	4	3 00
6	6 7-8	4 3-8	3 25
7	7 1-2	4 7-8	3 50
8	8 1-8	5 1-2	3 75
9	8 7-8	6 1-8	4 00
10	9 3-4	6 7-8	5 00
11	10 5-8	7 5-8	6 00
12	11 3-8	8 1-4	8 00
13	12	8 3-4	10 00
14	12 1-2	9 1-4	12 00
15	13 1-8	9 3-4	14 00
16	13 1-2	10 1-4	16 00
17	13 3-4	10 3-4	19 00
18	14 1-4	11 1-4	22 00

List of Standard Tapers, page 298.

# Style 89-F. Tool Steel Taper Pins.

**Taper**  
1-4" per foot.



These Taper Pins are made to meet the rapidly growing demand for a tool steel Pin accurately ground to size.

In ordering special Taper Pins, give the following

information: Length, Diameter at Small End, and Taper per Foot.

Number.	00	0	1	2	3	4	5	6	7	8	9	10
Diam. at Small End.	.118"	.135	.146	.162	.183	.208	.240	.279	.331	.398	.482	.581
Approx. Frac. Sizes.	1-8"	9-64	9-64	5-32	3-16	7-32	1-4	9-32	11-32	13-32	15-32	19-32
Length.	PRICE PER HUNDRED.											
11-32"	..	\$1 80	..	..	..	..	..	..	..	..	..	..
7-16	..	1 80	..	..	..	..	..	..	..	..	..	..
1-2	\$1 80	1 80	..	..	..	..	..	..	..	..	..	..
9-16	1 80	1 80	..	..	..	..	..	..	..	..	..	..
5-8	1 80	1 80	..	..	..	..	..	..	..	..	..	..
11-16	1 80	1 80	..	..	..	..	..	..	..	..	..	..
3-4	1 80	1 80	\$2 00	\$2 10	\$2 30	\$2 50	\$2 75	\$3 00	..	..	..	..
13-16	1 90	1 90	2 10	2 20	2 40	2 60	2 85	3 10	..	..	..	..
7-8	1 95	1 95	2 15	2 25	2 45	2 65	2 90	3 15	..	..	..	..
15-16	2 00	2 00	2 20	2 30	2 50	2 70	2 95	3 20	..	..	..	..
1	2 05	2 05	2 25	2 35	2 55	2 75	3 00	3 25	\$3 75	..	..	..
1 1-8	..	2 10	2 35	2 45	2 65	2 85	3 10	3 35	3 85	..	..	..
1 3-16	..	2 20	2 45	2 55	2 75	2 95	3 20	3 45	3 95	..	..	..
1 1-4	..	*2 30	2 50	2 60	2 80	3 00	3 25	3 50	4 00	\$4 65	..	..
1 5-16	..	2 35	2 55	2 70	2 90	3 10	3 35	3 60	4 10	4 70	..	..
1 3-8	..	2 40	2 60	2 75	2 95	3 15	3 40	3 65	4 15	4 80	..	..
1 7-16	..	2 50	2 70	2 80	3 00	3 20	3 45	3 70	4 20	4 90	..	..
1 1-2	..	2 55	2 75	2 85	3 05	3 25	3 50	3 75	4 25	5 00	\$7 00	\$9 00
1 9-16	..	..	..	2 95	3 10	3 30	3 55	3 80	4 30	5 10	7 15	9 15
1 5-8	..	..	..	3 00	3 20	3 40	3 65	3 90	4 40	5 25	7 30	9 30
1 3-4	..	..	..	*3 10	3 30	3 50	3 75	4 00	4 50	5 40	7 50	9 50
1 7-8	..	..	..	3 25	3 45	3 60	3 90	4 15	4 60	5 60	7 75	9 75
2	..	..	..	3 35	*3 55	3 75	4 05	4 35	4 75	5 80	8 00	10 00
2 1-8	..	..	..	..	3 70	3 90	4 20	4 55	5 00	6 00	8 30	10 35
2 1-4	..	..	..	..	3 80	*4 00	4 40	4 75	5 25	6 25	8 60	10 75
2 3-8	..	..	..	..	3 95	4 15	*4 60	4 95	5 50	6 50	8 90	11 10
2 1-2	..	..	..	..	4 05	4 25	4 75	5 20	5 75	6 75	9 20	11 50
2 3-4	..	..	..	..	4 30	4 50	5 10	5 70	6 25	7 25	9 80	12 25
3	..	..	..	..	4 55	4 75	5 45	6 25	6 75	7 80	10 50	13 25
3 1-4	..	..	..	..	..	..	..	6 75	7 25	8 40	11 20	14 25
3 1-2	..	..	..	..	..	..	..	..	7 75	9 00	11 90	15 25
3 3-4	..	..	..	..	..	..	..	..	8 25	9 60	12 60	16 25
4	..	..	..	..	..	..	..	..	..	10 20	13 30	17 25
4 1-4	..	..	..	..	..	..	..	..	..	10 80	14 00	18 25
4 1-2	..	..	..	..	..	..	..	..	..	11 40	14 70	19 25
4 3-4	..	..	..	..	..	..	..	..	..	..	15 40	20 25
5	..	..	..	..	..	..	..	..	..	..	16 10	21 25
5 1-4	..	..	..	..	..	..	..	..	..	..	16 80	22 25
5 1-2	..	..	..	..	..	..	..	..	..	..	..	23 25
5 3-4	..	..	..	..	..	..	..	..	..	..	..	24 25
6	..	..	..	..	..	..	..	..	..	..	..	25 25

\*These Pins and those larger are too long to be used with the regular Taper Pin Reamers of corresponding numbers

## Ground Flat Stock.

This Stock is of service not only in tool work for making flat gauges, test tools, "jig work," etc., but in all work requiring steel of a definite thickness.

This Stock is of first quality tool steel, cut the length of the sheet, annealed and ground to within a limit of .001" of the given thickness.

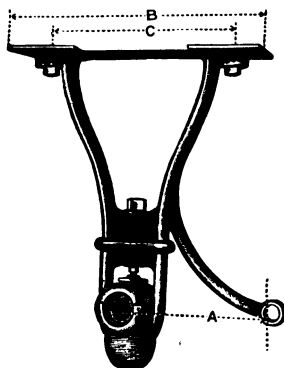
### PRICES.

Size in Inches.	Approx. Weight.	Price per Pound.	Size in Inches.	Approx. Weight.	Price per Pound.
<b>1-64</b>	ozs.		<b>5-32</b>	lbs.	
2 x 18 x 1-64	3	\$3 00	1 x 18 x 5-32	7-8	\$0 60
2½ x 18 x 1-64	3 1-2	3 00	1½ x 18 x 5-32	1 1-8	0 60
3 x 18 x 1-64	4	3 00	2 x 18 x 5-32	1 3-4	0 50
3½ x 18 x 1-64	4 1-2	3 00	2½ x 18 x 5-32	2	0 50
4 x 18 x 1-64	5 1-2	3 00	3 x 18 x 5-32	2 1-2	0 50
			3½ x 18 x 5-32	2 3-4	0 50
			4 x 18 x 5-32	3 1-4	0 50
<b>1-32</b>			<b>3-16</b>		
2 x 18 x 1-32	6	1 25	1 x 18 x 3-16	1	0 50
2½ x 18 x 1-32	7	1 25	1½ x 18 x 3-16	1 1-2	0 50
3 x 18 x 1-32	8	1 25	2 x 18 x 3-16	2	0 45
3½ x 18 x 1-32	9	1 25	2½ x 18 x 3-16	2 1-2	0 45
4 x 18 x 1-32	11	1 25	3 x 18 x 3-16	3	0 45
			3½ x 18 x 3-16	3 1-2	0 45
<b>1-16</b>	lbs.		4 x 18 x 3-16	4	0 45
1 x 18 x 1-16	3-8	0 90	<b>7-32</b>		
1½ x 18 x 1-16	1-2	0 90	1 x 18 x 7-32	1 1-8	0 50
2 x 18 x 1-16	3-4	0 80	1½ x 18 x 7-32	1 3-4	0 50
2½ x 18 x 1-16	7-8	0 80	2 x 18 x 7-32	2 1-4	0 45
3 x 18 x 1-16	1	0 80	2½ x 18 x 7-32	2 7-8	0 45
3½ x 18 x 1-16	1 1-8	0 80	3 x 18 x 7-32	3 1-2	0 45
4 x 18 x 1-16	1 3-8	0 80	3½ x 18 x 7-32	4	0 45
			4 x 18 x 7-32	4 5-8	0 45
<b>3-32</b>			<b>1-4</b>		
1 x 18 x 3-32	1-2	0 75	1 x 18 x 1-4	1 3-8	0 45
1½ x 18 x 3-32	3-4	0 75	1½ x 18 x 1-4	2	0 45
2 x 18 x 3-32	1	0 65	2 x 18 x 1-4	2 5-8	0 40
2½ x 18 x 3-32	1 1-4	0 65	2½ x 18 x 1-4	3 1-4	0 40
3 x 18 x 3-32	1 1-2	0 65	3 x 18 x 1-4	4	0 40
3½ x 18 x 3-32	1 3-4	0 65	3½ x 18 x 1-4	4 1-2	0 40
4 x 18 x 3-32	2	0 65	4 x 18 x 1-4	5 1-8	0 40
<b>1-8</b>					
1 x 18 x 1-8	5-8	0 60			
1½ x 18 x 1-8	1	0 60			
2 x 18 x 1-8	1 3-8	0 50			
2½ x 18 x 1-8	1 3-4	0 50			
3 x 18 x 1-8	2	0 50			
3½ x 18 x 1-8	2 1-4	0 50			
4 x 18 x 1-8	2 5-8	0 50			

Other sizes furnished to order.

Prices upon application.

## Self-Oiling Hangers.



The above cut represents a Hanger which is provided with a receptacle for oil for the purpose of lubricating the bearings, the oil being fed to the same by capillary attraction. This hanger is made with or without arms and with one end of the drip closed or both ends open.

### No. 1.

**Takes Boxes 1" x 4" or 1 1-4" x 4 1-2".**

Drop.	Distance from Center of Shaft to Shipper Rod. A	Extreme Width. B	Distance between Centres of Bolt Holes. C	Diameter of Holes.	Single Hanger.	Pair of Hangers.
10"	No arm.	16"	12 1-8"	3-4"	\$2 50	
10	7 9-16	16	12 1-8	3-4	2 75	\$5 50
10	8 5-16	16	12 1-8	3-4	2 75	5 50
12	No arm.	16	12 1-8	3-4	2 50	
12	7 9-16	16	12 1-8	3-4	2 75	5 50
12	8 5-16	16	12 1-8	3-4	2 75	5 50
12	9 7-16	16	12 1-8	3-4	2 75	5 50
12	10 9-16	16	12 1-8	3-4	2 75	5 50
16	No arm.	16	12 1-8	3-4	2 75	
16	7 9-16	16	12 1-8	3-4	3 00	6 00
16	8 5-16	16	12 1-8	3-4	3 00	6 00
16	9 7-16	16	12 1-8	3-4	3 00	6 00
17	No arm.	16	12 1-8	3-4	2 75	
18	No arm.	16	12 1-8	3-4	2 75	

## Self Oiling Hangers.

### No. 2.

**Takes Boxes 1 1-2" x 6" or 1 5-8" x 6 1-2".**

Drop.	Distance from Centre of Shaft to Shipper Rod. A	Extreme Width. B	Distance between Centres of Bolt Holes. C	Diameter of Holes.	Single Hangers.	Pair of Hangers.
12"	No arm.	16"	12 1-8"	7-8"	\$3 25	
12	9 7-16"	16	12 1-8	7-8	3 50	\$7 00
12	11 5-16	16	12 1-8	7-8	3 50	7 00
12	9 7-16 & 11 7-16	16	12 1-8	7-8	3 50	7 00
12	11 5-16 & 13 1-16	16	12 1-8	7-8	3 50	7 00
16	No arm.	16	12 1-8	7-8	3 50	
16	9 7-16	16	12 1-8	7-8	3 75	7 50
16	11 1-16	16	12 1-8	7-8	3 75	7 50
16	11 1-16 & 13 1-16	16	12 1-8	7-8	3 75	7 50

### No. 3.

**Takes Boxes 1 11-16" x 6 1-2", 1 15-16" x 7" or 2 3-16" x 7 1-2".**

12"	10 13-16"	19"	15"	1 1-8"	\$7 00	\$14 00
12	10 13-16 & 12 13-16	19	15	1 1-8	7 00	14 00
14	12 13-16	19	15	1 1-8	7 50	15 00
14	12 13-16 & 14 13-16	19	15	1 1-8	7 50	15 00

### No. 5\*.

**Takes Boxes 2" x 8", 2 3-16" x 9" or 2 7-16" x 10".**

16"	No arm.	22"	18"	1 1-8"	\$10 00	
16	12 9-16"	22	18	1 1-8	10 50	\$21 00
16	12 9-16 & 14 9-16	22	18	1 1-8	10 50	21 00

Two shipper rod stops and one shipper dog accompany each pair of hangers with arms. When hangers and friction pulleys are ordered together, we will send a shipper fork for operating the thimble. When hangers and tight and loose pulleys are ordered together, we will send belt guides.

\*Differs slightly from one shown in cut.

## Counter-Shafts

### With Friction Pulleys, Hangers and Boxes.

Price includes shaft, one pair of Patent Self-Oiling Friction Pulleys, page 350, Hangers with self-oiling boxes, page 348, shipper rod, forks and stops and stud for attaching shipper handle.

With Friction Pulleys. Diameter.	Length of Shaft in Clear between Hangers.	Diameter of Shaft.	Diameter of Bearing.	Price.
8"	26"	1 1-4"	1"	\$19 00
10	33	1 1-4	1	23 00
12	33	1 1-2	1 1-4	26 00
14	33	1 1-2	1 1-4	28 00
16	44	1 11-16	1 1-2	34 00
18	44	1 11-16	1 1-2	38 00

## Self-Oiling Friction Pulleys.



We have in our works a large number of these pulleys. They are simple in construction and noiseless when in use. Friction is applied in the most effective manner, as the pads act directly on the rims of the pulleys. The centre oil pocket is an important feature. All the parts are easily adjusted to compensate for wear.

Each pair of pulleys has one thimble and two collars; each single pulley has one thimble and one collar.

When ordering two or more pulleys, state if same are to be used singly or in pairs.

Diameter.	Belt.	Hole.	Price per Pair.	Price Each.
8"	2 1-4"	1 1-4"	\$11 00	\$6 00
10	3	1 1-4	15 00	8 00
12	3 1-2	1 1-2	17 00	9 00
14	3 1-2	1 1-2 or 1 11-16	19 00	10 00
16	4	1 11-16	23 00	12 00
18	4 1-2	1 11-16	27 00	14 00

### Space on Shaft required to operate Friction Pulleys.

Diameter of Pulley.	Single Pulley.	Pair of Pulleys.
8"	10"	16 1-4"
10	12 3-8	20
12	14	23
14	14	23 1-4
16	15	25
18	15 1-2	26

### Highest speed at which these Pulleys can satisfactorily be run.

8"— 450 revolutions per minute.

14"— 275 revolutions per minute.

10"— 375 revolutions per minute.

16"— 250 revolutions per minute.

12"— 325 revolutions per minute.

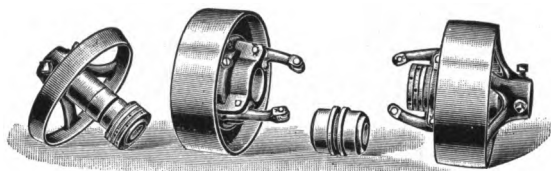
18"— 225 revolutions per minute.

Pulleys with special holes furnished when desired.

Price, single pulley, \$2 50 extra. Two or more pulleys, \$2 25 each, extra.

# Self-Oiling Friction Pulleys.

Design of 1895.



These pulleys are designed for high speed and hard service and are furnished with our Wire Feed Screw Machines. The pulley runs on the hub of the inner friction surface and is provided with a ring oiler, which amply lubricates the bearing when the pulley is running idle.

Each pair of pulleys and each single pulley is furnished with one thimble.

When ordering two or more pulleys, state if same are to be used singly or in pairs.

Diameter.	Belt.	Size of Hole.	Weight. lbs.	Price Single Pulley.	Price per Pair.
8"	2 1-2"	1 1-4" or 1 1-2"	23	\$9 00	\$17 00
10	3	1 1-2 or 1 11-16	37	11 00	21 00
12	3 1-2	1 1-2, 1 11-16 or 1 15-16	59	13 50	26 00
14	4	1 11-16 or 1 15-16	74	15 50	30 00
16	4 1-2	1 11-16, 1 15-16 or 2 3-16	93	18 00	35 00
18	6	2 3-16	172	31 00	61 00

## Space on Shaft required to operate Friction Pulleys.

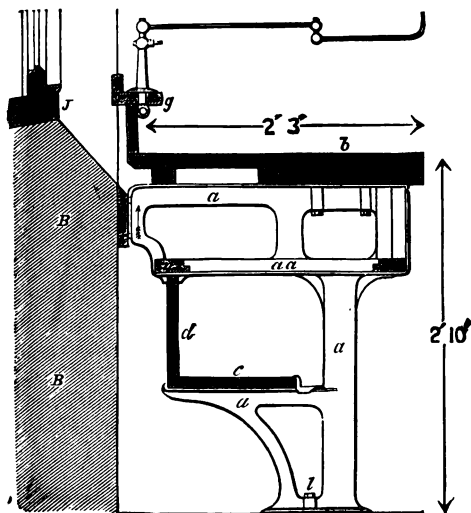
Diameter.	Single Pulley.	Two Pulleys.	Three Pulleys.
8"	11 1-8"	19"	36 1-8"
10	10 3-4	18 1-2	35 3-8
12	12 1-4	21 1-2	39 1-2
14	14 1-4	24 3-4	46 1-2
16	16 1-2	28 3-4	53 3-4
18	20 1-2	36 7-8	

Pulleys with special holes furnished when desired.

Price, single pulley, \$2 50 extra. Two or more pulleys, \$2 25 each extra.

It is often desirable to run the spindle of a Screw Machine at different speeds in the same direction; for this purpose we make a special pulley with long levers and a special thimble. Three pulleys can thus be operated with one shipper rod.

## Improved Work Bench.



The above cut shows an improved design of Bench for Iron and Wood work. The leg or casting *a* consists of a rigid standard, a bracket for the support of the shelf *c*, and its accompanying back. The legs or standards are fastened to the floor by coach screws, shown at *l*, and are supported at the back by the wall *B B*. They are usually placed about 4 feet apart and support the bench *b*, the shelf *g*, the frame-work *n*, and the shelf *c*, with its accompanying back. The frame-work *n n* forms a strong support upon which slide the drawers. The shelf *c* supported by the brackets is held in place by the cast iron clip, shown at the front. The shelf *g* affords a neat and substantial support for the gas brackets. The front of the leg or standard is provided with a hole to receive the bolt for holding the vise and this construction brings the vise directly over the leg or standard.

We are prepared to furnish complete sets of castings for patterns for the iron work of the above described bench, or castings complete for benches, drilled ready for use. Weight of leg casting complete, about 56 lbs.

Drawings, showing instructions, sent with orders

If ordering in quantities of 25 or more at one time, there will be a discount of 10 per cent from the following prices:

Bench Leg Castings . . . . .	Price, each	\$3 75
Corner Legs . . . . .	Price, each	4 75
Pattern Castings . . . . .	Price, each	14 00



## Improved Bench Centres.

8 in.  $\times$  36 in.



**Price, with Indicator, \$85 00. Without Indicator, \$68 00.**

These Centres swing 8" in diameter and take 36" in length.

The Head and Foot-stock Spindles are of steel, ground and accurately fitted. The foot-stock centre is held firmly in contact with the work by a stiff spring and, as the spindle is quickly operated by a lever, work can be easily placed in position and removed. Provision is made for clamping the foot-stock spindle when desired.

The Dial Test Indicator furnished with these centres is shown and described on page 165.

It is supported by a rest, that can be moved longitudinally on the bed.

The sleeve that holds the arm can be clamped at any height on the post or turned around to bring the arm on either side. The arm turns in the sleeve and may be set at any angle relative to the base. All parts are detachable.

The movement of the contact point that bears upon the work is magnified a number of times and indicated by the pointer on a dial. The dial reads to .001" and can be adjusted to allow the setting of the zero graduation to any required position.

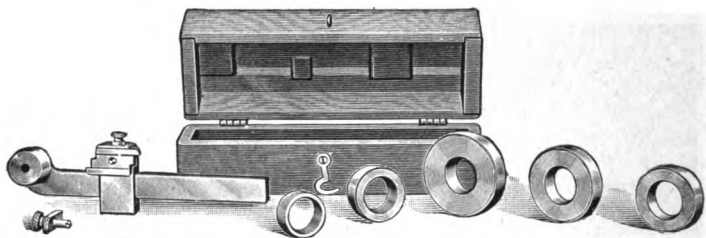
The dial can also be furnished to read to 1-100th of a m/m.

A Work Support is furnished.

All the parts are movable on the bed and are clamped in position by screws provided with fixed handles, thus dispensing with wrenches.

**Weights.** Net, about 140 lbs.; ready for shipment, about 190 lbs. Dimensions for shipment, 55"  $\times$  12"  $\times$  14". Space occupied, about 5 cubic feet.

## Cutter Clearance Gauge.

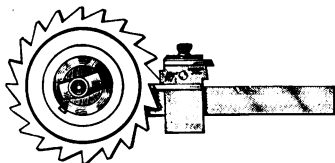


**Price, \$30 00.**

This Gauge is designed for the purpose of aiding the operator in grinding the correct angle of clearance on milling cutters. It consists of a hardened steel bar 6 1-2" long, to one end of which is attached a hardened stud 7-8" in diameter for holding the cutters. A set of five bushings is provided for the stud so that cutters having holes 7-8", 1", 1 1-4", 1 1-2", 1 3-4" and 2" may be tested. The bushing is held in place on the stud by a spring stop.

The Gauge is mounted on a slide which is easily moved along the bar.

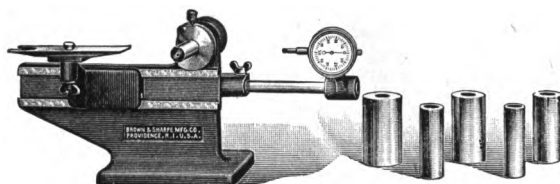
It is attached to the side of the slide by a pin which allows it to be revolved, one end being used for cutters under 3" in diameter, the other end for cutters 3" in diameter and over.



To test for correct clearance the cutter is placed on the stud with proper bushing, and the Gauge pushed forward. The cutter is then revolved sufficiently to bring the face of a tooth in contact with the stop on the Gauge which gives the correct position for the cutter. The angle of clearance on the tooth should then correspond to the angle of the gauge. Cutters of any width may be tested with the gauge.

The Gauge and bushings are packed in a finished wooden box as shown above.

## Cutter Testing Fixture.



**Price, \$46 00.**

**Without Indicator, \$33 00.**

Gear and formed cutters are designed in such a manner that the faces of the teeth must be ground radially and all teeth must be of even height whenever they are sharpened. This fixture is designed especially for detecting the slightest inaccuracies in grinding. All sizes of cutters up to 10" in diameter can be accommodated.

A cutter is tested by bringing the face of each tooth to bear upon a hardened steel plate whose top surface is radial with the stud upon which the cutter is supported; all points of the cutting contour should simultaneously touch the surface of the testing plate. At the same time the dial indicator shows whether the teeth are all of the same height.

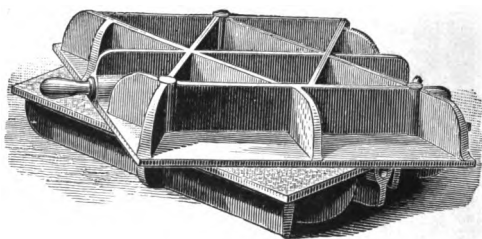
The testing plate is reversible and is attached by a bolt and thumb nut to a slide that moves in horizontal ways cut in the side of the Fixture body. By this arrangement the plate can be readily inserted to test a tooth and withdrawn to permit the following tooth to be brought into position. A taper gib on the slide provides means of taking up the wear and keeping the surface of the testing plate correctly lined.

The stud upon which the cutters are supported is made of hardened steel, 5-8" diameter. It has a taper shank which fits into a taper steel sleeve that is fastened securely in the Fixture body.

The dial indicator reads to thousandths of an inch. It can also be furnished with a metric dial to read to 1-100th of a m/m.

Equipment: Five bushings, hardened and ground, 7-8", 1", 1 1-4", 1 1-2" and 1 3-4" diameter and a collar for use when testing thin cutters.

## Standard Cast Iron Surface Plates.



We have in stock a variety of sizes, to which we frequently make additions, all of which are uniform in style.

These plates are usually sold singly, not in pairs, as shown in cut. Unless otherwise specified, price is quoted for single plate with cover.

Size.	Weight about.	Price Each.	Size.	Weight about.	Price Each.
3 1/2" x 4"	2 lbs	\$2 75	12" x 18"	58 lbs.	\$28 00
3 1/2" x 12	10	5 50	12 x 24	92	39 00
4 x 7	6	4 00	12 x 36	158	57 00
4 x 15	17	8 00	*12 x 144	2000	221 00
4 x 18	18	9 50	*12 x 65	390	105 00
*4 x 40	80	21 00	14 x 14	52	24 00
4 1/2 x 6	5	4 00	14 x 18	58	32 00
5 x 16	18	10 50	14 x 21	78	39 00
6 x 6	6	5 00	15 x 30	160	60 00
6 x 12	15	9 50	16 x 16	66	32 00
6 x 26	46	19 00	16 x 48	355	110 00
6 x 50	105	41 00	18 x 18	90	41 00
*6 x 72	280	57 00	18 x 24	120	55 00
6 1/2 x 18	30	17 00	18 x 36	180	73 00
7 x 7 1/2	10	7 00	20 x 30	200	79 00
7 x 10	15	9 00	24 x 24	205	75 00
8 x 12	19	12 50	24 x 36	285	115 00
9 x 9	16	10 00	24 x 48	485	154 00
9 x 14	29	15 50	24 x 60	696	200 00
10 x 15	39	19 00	30 x 36	375	144 00
10 x 30	86	40 00	30 x 60	800	248 00
10 x 50	190	66 00	36 x 68	1355	352 00
12 x 12	30	18 00			

\* Made to order only.

## Cast Iron Straight Edges.



These Straight Edges are of a form best adapted to retain a straight line.

The edge of each is scraped to form a true surface, and the straight edges when thus made are indispensable in the proper scraping of the ways of planer and lathe beds, etc.

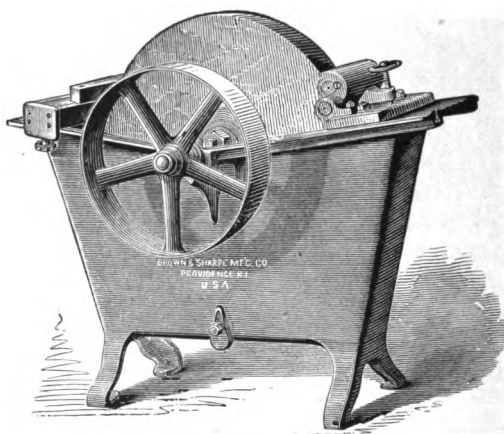
Size.	Weight.	Price.
18" x 1 1-2"	5 lbs.	\$8 00
24 x 1 5-8	10	10 50
30 x 1 3-4	15	13 50
36 x 1 7-8	15	16 50
48 x 2	35	22 50
60 x 2 1-8	50	29 00
72 x 2 1-4	75	36 50
84 x 2 5-16	120	40 00
96 x 2 3-8	145	43 00
120 x 2 3-4	300	55 00
*144 x 3	420	
*180 x 3 1-2	835	

Price includes cover.

\*Made to order only.

Price upon application.

## Grindstone Trough.



This cut illustrates a Grindstone Trough combining a number of very desirable features. In addition to the ordinary arrangement of trough, spindle and pulley, which is 20" diameter, 4 1-2" face, it is provided with self-oiling boxes, and an adjustable truing device, which can be instantly applied to the face of the stone, working automatically, and without dust, keeping the face always in good shape, without interfering with its constant use.

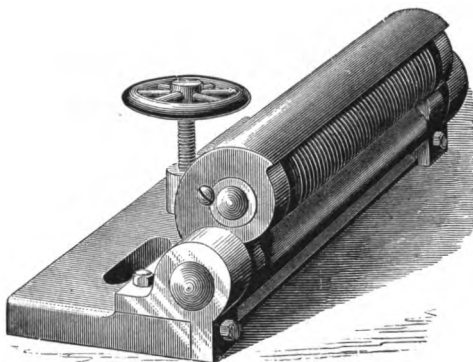
**DIRECTIONS.**—The stone should revolve so as to have the device upon the face which moves upwards. The main stand or bottom piece of the device is securely clamped upon the trough close to the face of the stone, then by turning the hand wheel the threaded roll is brought into contact with the stone and allowed to remain as long as is requisite to produce the desired result. The water is to be left in the trough as usual. When by long use the thread on the hardened roll becomes worn, it can be re-cut, which operation can be repeated. The stone should revolve at a surface speed of about 500 to 550 feet per minute.

**Weights.** Net, about 575 lbs.; with stone 39" diameter, 5" face, about 1100 lbs. Ready for shipment, about 650 lbs.; with stone 39" diameter, 5" face, about 1325 lbs.

Price includes tool rest and truing device, f.o.b. Providence, R. I.

Price, without stone, \$80 00; with stone \$95 00.

## Grindstone Truing Device.



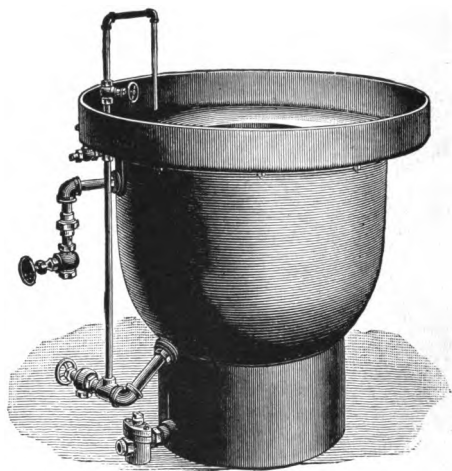
One of the most disagreeable things to be done in a work shop is the truing of grindstones. Therefore, it is often the case that they are allowed to become out of shape and untrue, very much to the annoyance of the workman, who finds it almost impossible to grind his tools in a proper manner. The above cut represents a device which is well adapted for truing and keeping the face of grindstones constantly in good shape. This can be instantly applied to the face of the stone, working automatically and without dust, keeping the face always in good shape, without interfering with its constant use.

**DIRECTIONS.**—The main stand or bottom piece is securely clamped upon the trough, close to the face of the stone; then by turning the hand wheel, the threaded roll is brought into contact with the face of the stone and is allowed to remain as long as is requisite to produce the desired result. The water is to be left as usual in the trough. When by long use the thread on the hardened roll becomes worn, it can be re-cut, which operation may be repeated. The stone should revolve so as to have the device upon the face which moves upward, and the device should be well oiled before it is used.

The device should not be used on stones revolving at a greater surface speed than about 500' or 550' per minute.

Price, with 7" roll . . . . .	\$14 50
Price, with 12" roll . . . . .	18 50
Price of 7" roll . . . . .	6 75
Price of 12" roll . . . . .	8 75

## Soda Kettle.



This Kettle is used for cleaning or removing grease and dirt from small tools and parts of machines. A coil of steam pipe is employed to heat the water, in which a quantity of soda has been placed, and the pieces immersed in the solution when taken out dry without rusting.

The kettles are usually made with round tops and stand in the centre of the room among the machines, but they are also made of a form suitable to place against a wall or in a corner.

Outside diameter of top plate, 38"; diameter of kettle, 29"; diameter of inside coil of pipe, 24"; height from floor to top of flange, 37"; depth of kettle, 22"; diameter of wire basket or cage for receiving the work, 11"; depth of basket, 16". Capacity of kettle, about 60 gallons.

A perforated bucket or shaker, 6 1-4" diameter, 13" long, is conveniently used in washing small pieces.

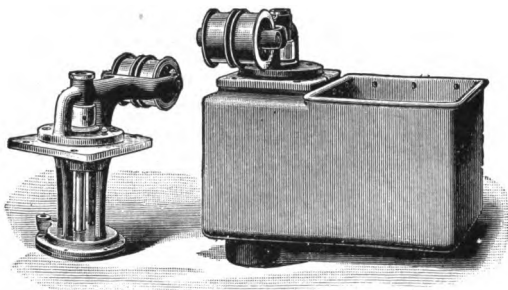
**Weights.** Net, about 630 lbs.; ready for shipment, about 800 lbs. Dimensions for shipment, 40" x 40" x 40". Space occupied, about 36 cubic feet.

**Equipment.** Interior coil of pipe, wire basket, perforated bucket or shaker and the pipe with valves, etc., as shown in cut.

**Price,** f. o. b. Providence, \$90 00.



## Centrifugal Water Pumps.



No.	Height Forced.	4 feet.	8 feet.	12 feet.	16 feet.	20 feet.	Dis- charge.	Net Weight.
	Rev. per Minute.	Capacity, Quarts per Minute.						
2	800	7 qt.	. . .	. . .	. . .	. . .	3-8"	40 lbs.
	1000	13 "	6 qt.	. . .	. . .	. . .		
	1500	24 "	20 "	14 qt.	5 qt.	. . .		
4	500	8 "	. . .	. . .	. . .	. . .	3-4"	85 lbs.
	750	24 "	16 qt.	. . .	. . .	. . .		
	1200	96 "	53 "	40 qt.	28 qt.	16 qt.		

Minimum speed at which No. 2 Pump should run to raise water 4 feet, 800 rpm; No. 4, 500 rpm.

Driving pulley, No. 2 Pump, 2" diameter for 1" belt; No. 4 Pump, 2 3-4" diameter for 1 1-4" belt.

These pumps are for use with water only and, as the bearings do not come in contact with the water, are well adapted for use on grinding or other machines where the water used contains a large amount of emery particles or grit.

The pump consists of a simple fan revolving in a case. The fan revolves in a horizontal plane and is immersed in the water. By this method the pump is constantly primed and there is no leak from loose packings.

The driving belt, which makes a quarter turn around the idle pulleys, furnished with the pump, can run over the counter-shaft or can run over pulleys connected with some part of the machine.

The bracket, which supports the idle pulleys, is held by two bolts that slide in slots, thus allowing the pulleys to be set in any desired position.

Prices. No. 2 Pump, \$8 00; No. 4 Pump, \$20 00.

### Tanks for Nos. 2 and 4 Pumps.

Tanks especially designed for use with these pumps, provided with a straining pan and plug to draw off the water, can be furnished when desired.

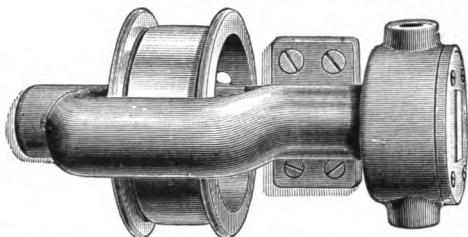
For No. 2: Price, \$9 00.

Weight, 67 lbs.

For No. 4: Price, 27 00.

Weight, 165 lbs.

## No. 8 Oil Pump.



Revolutions per Minute.	Capacity, Qts. per Min.	Height Forced.	Suction.	Discharge.	Weight.
100	1	12 feet.	1-4"	1-4"	8 1-2 lbs.
300	2	16 "		1-4	
500	4	20 "		1-4	

Driving Pulley, 3 1-2" diameter for 1" belt.

This Pump is used in supplying oil to the cutting tools of metal working machines, as Screw Machines, Lathes, Bolt Cutters, etc. It changes automatically, to pump when running in either direction, thus supplying a constant flow of oil. By placing the stops on the eccentric ring to the right or left of the pins in the case, either side of the pump can be used for the suction.

To obtain the best results, the pump should be placed as near as possible to the level of the oil in the tank.

Price, \$5 50. Without pulley, \$4 50.

## Nos. 11, 12 and 13 Geared Pumps.

For Oil or Water. Run in either direction.

No.	Revolutions per Minute.	Capacity, Qts. per Min.	Height Forced.	Suction.	Discharge.	Weight.
11	300	4	20 feet.	3-8"	1-4" or 3-8"	10 lbs.
	500	8	20 "			
12	300	12	20 "	1-2	3-8 or 1-2	15 "
	500	24	20 "			
13	300	20	20 "	3-4	1-2 or 3-4	30 "
	500	40	20 "			

Driving Pulley, No. 11, 3 1-2" diameter for 1" belt; No. 12, 4 1-4" diameter for 1" belt; No. 13, 5" diameter for 1 1-4" belt.

These Pumps are similar in design to the Geared Pumps described on following page and are adapted for use on machines where the cutting tools operate in more than one direction, as Screw Machines or machines that reverse.

Price, No. 11, \$8 25. Without pulley, \$7 25.

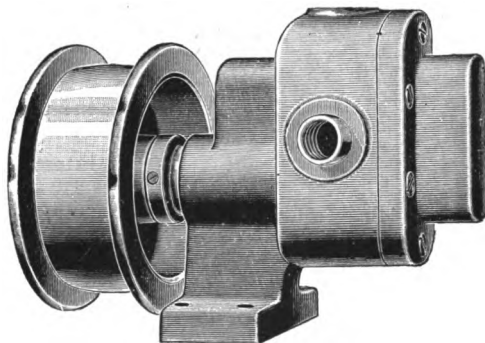
Price, No. 12, \$11 00. Without pulley, \$9 75.

Price, No. 13, \$14 50. Without pulley, \$13 00.

For Valves and Fittings, see pages 364 and 365.

## Nos. 1 and 3 Geared Pumps.

For Oil or Water.



No.	Revolutions per Minute.	Capacity, Quarts per Minute.	Height Forced.	Suction.	Discharge.	Weight.
1 {	300	4	20 feet	} 3-8"	1-4" or 3-8"	8 lbs.
	500	8	20 "			
3 {	300	20	20 "	} 3-4	1-2 or 3-4	24 "
	500	40	20 "			

Driving Pulley for No. 1, 3 1-2" diameter for 1" belt.

Driving Pulley for No. 3, 5" diameter for 1 1-4" belt.

These Pumps are principally used on machines where the cutting tools operate only in one direction, as Milling Machines, Gear Cutting Machines, Chucking Machines, etc., but, by running the pumps independently, they can be used on machines that reverse. They are simple in construction, the principal mechanism being a pair of gears which run together in a tight case.

To obtain the best results the pump should be placed as near as possible to the level of the liquid in the tank.

Price, No. 1, \$6 75. Without pulley, \$5 75.

Price, No. 3, \$9 50. Without pulley, \$8 00.

## Nos. 21 and 23 Bronze Circulating Pumps.

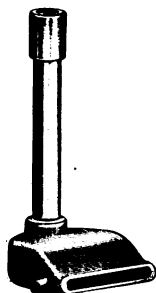
These pumps differ from Nos. 1 and 3 only in being made entirely of bronze.

Price, No. 21, \$9 00; without pulley, \$8 00. Weight, complete, 7 lbs.

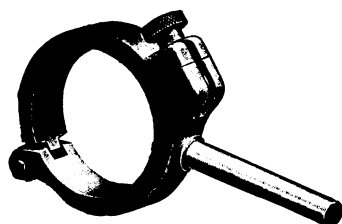
Price, No. 23, \$18 00; without pulley, \$16 50. Weight, complete, 20 lbs.

## Pump Accessories.

### FOR MILLING MACHINES.



Distributer.



Distributer Bracket.



Distributer Swivel.



Check Valve.



Relief Valve.



Valve.

### Distributer.

	Price.
For Nos. 1 and 11 Geared Pumps, Pipe Size 1-2" . . . . .	\$2 00
For No 12 Geared Pump, Pipe Size 3-4" . . . . .	2 50
For Nos. 3 and 13 Geared Pumps, Pipe Size 1" . . . . .	3 00

### Distributer Bracket.

For 2 3-4" Overhanging Arm . . . . .	\$3 00
For 3 1-2" Overhanging Arm . . . . .	3 50
For 4 1-4" Overhanging Arm . . . . .	3 75
For 4 1-2" Overhanging Arm . . . . .	4 00
For 4 3-4" Overhanging Arm . . . . .	4 25
For 5" Overhanging Arm . . . . .	4 50

### Distributer Swivel.

For Use with 1-2" Distributer . . . . .	\$1 75
For Use with 3-4" Distributer . . . . .	1 75
For Use with 1" Distributer . . . . .	2 00

### Valve.

For Use with 1-2" Distributer, Pipe Size 1-2" . . . . .	\$4 00
For Use with 3-4" Distributer, Pipe Size 3-4" . . . . .	4 50
For Use with 1" Distributer, Pipe Size 1" . . . . .	5 50

### Check Valve.

3-8" . . . . .	\$0 45	1-2" . . . . .	\$0 55	3-4" . . . . .	\$0 65
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### Relief Valve.

1-4" . . . . .	\$1 00	3-8" . . . . .	\$1 25	1-2" . . . . .	\$1 50
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Continued on next page.

## Pump Accessories (Cont.)

### FOR MILLING MACHINES.



Flexible Tube Swivel for Base.  
Flexible Tube Swivel for Table.



Strainer.

### Flexible Tube Swivel for Base.

### Flexible Tube Swivel for Table.\*

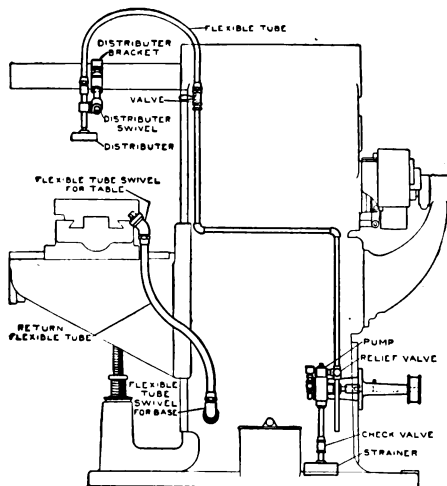
Used with Nos. 1 and 11 Geared Pumps, Pipe Size 3-4" . . . . .	\$1 50
Used with No. 12 Geared Pump, Pipe Size 1" . . . . .	2 50

\*45° for Universal Milling Machines; 90° for Plain Milling Machines. In ordering flexible tube swivels give name and number of machine, also state whether swivel is for base or table.

### Strainer.

For No. 8 Oil Pump, Pipe Size 1-4" . . . . .	\$0 75
For Nos. 1 and 11 Geared Pumps, Pipe Size 3-8" . . . . .	1 00
For No. 12 Geared Pump, Pipe Size 1-2" . . . . .	1 25
For Nos. 3 and 13 Geared Pumps, Pipe Size 3-4" . . . . .	1 50

Other parts except flexible tubes are ordinary gas pipe and fittings.



Arrangement of Oil Piping for Milling Machines.

# Cast Iron Packing Boxes.

FOR USE IN

**Case-Hardening and Annealing Furnaces.**

Dimensions are all inside measurements.

In ordering, please give pattern numbers.

## Rectangular Boxes.

Pattern No.	Length.	Width.	Depth.	Weight lbs.	Price.	Dumping Fork.
1	3 3-4"	1 7-8"	2"	2	\$0 30	
2	3 1-4	3 1-4	3 1-2	7	45	
3	4	4	5 1-2	12	75	5 1-2"
4	5 1-8	5 1-8	6	15	90	*6 1-8
5	6 7-8	6 1-8	5 1-2	22	1 35	7 1-2
6	6 7-8	6 1-8	7 1-2	26	1 60	7 1-2
7	7 3-8	5 1-4	9	38	2 30	*6 1 2
8	7 1-2	2 5-8	7 3-4	29	1 75	4
9	7 1-2	3 1-8	9 1-2	25	1 50	*5 1-4
10	9 3-4	3 3-8	3	14	85	*4 5-8
11	10 1-4	4 5 8	3 1-2	15	90	5 1-2
12	11 1-4	4 5-8	5 1-4	22	1 35	5 1-2
13	11 3-4	6 1-8	5 1-2	31	1 90	7 1-2
14	11 3-4	6	6 1-4	40	2 40	7 1-2
16	10 3-4	10 3-4	9	89	5 35	
17	13 3-4	4 5-8	4	24	1 45	5 1-2
18	13	9 3-4	7 7-8	95	5 70	
19	15 1-8	13 5-8	9 3-4	198	9 90	
20	18	9 1-2	9 1-2	101	5 85	
21	20	9	7 3-4	109	6 05	
22	28	9	8	132	6 60	
23	20 3-4	10 3-4	14 5-8	253	12 65	
24	20	14	20 1-4	461	23 00	
25	38	9 1-2	8	179	8 95	
26	14	6 1-4	6	51	3 10	7 1-2
30	7	6 1-4	6 5-8	21	1 30	7 1-2
37	8	4 3-4	10 1-2	39	2 35	5 1-2

List continued on next page.

\* Made to order.

# Cast Iron Packing Boxes (Continued.)

## Rectangular Boxes (Continued.)

Pattern No.	Length.	Width.	Depth.	Weight lbs.	Price.	Dumping Fork.
*41	22 1-2"	12 1-8"	15"	220	\$11 00	
*43	25	14	24	436	21 80	
44	11 3-4	6 1-8	7 1-2	41	2 50	7 1-2"
45	20	11	10	140	7 00	
46	18	4 1-2	6 1-2	70	4 20	
*47	25	4 3-4	9	112	6 15	
48	11 7-8	5 7-8	9 1-2	55	3 30	7 1-2
*50	12	6 1-4	6 1-2	35	2 10	7 1-2
*52	26	10 1-4	22 1-2	400	20 00	
53	8	3	6 3-4	15	90	4

\* Made to order.

## Round Boxes.

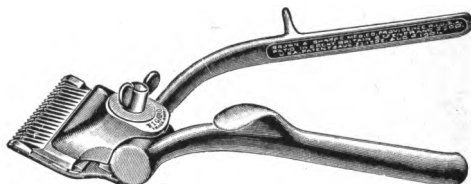
Pattern No.	Diameter.	Depth.	Weight lbs.	Price.
23	6"	6"	20	\$1 20
24	3 1-8	2 1-8	3	35
27	11 3-8	8	58	3 50
29	15 3-4	8	81	4 90
31	7	7 1-2	33	2 00
32	12 1-4	8	82	4 95
34	19 1-2	8 3-8	148	7 40
36	9	6	46	2 80
37	11 3-4	13	123	6 35
*40	2 5-8	2	5	40
45	14	8	100	5 80
46	13 3-4	14	158	7 90
47	7 3-4	9	45	2 70
48	9 1-2	12	85	5 10
50	13	14	126	6 50
53	24	9	251	12 55
58	14 3-4	14 3-4	224	11 20
60	8	10 1-2	53	3 20
61	7	9	40	2 40

\* Made to order.

# Figaro Hair Clippers.

**"FIGARO."**

Trade Mark Registered in United States, France, Germany, Japan, Argentina.



Patented August 6, 1901. Also Patented in France and Great Britain.

These Hair Clippers are durable, powerful, clean-cutting and unusually comfortable to the hand. They operate smoothly and when properly adjusted will not pull the hair.

They are somewhat lighter and have more power than those of early design. The action is uniform and the cut clean at all portions of the stroke. The washer cannot be lost, as it is fastened to the nut, which has wings and is very easily adjusted. The wings also prevent the nut from rolling and being lost if dropped when the Clipper is taken apart.

## PRICES.

No. 0.	To cut hair one-thirty-second of an inch long	\$3 00
No. 1.	To cut hair one-eighth of an inch long	3 00
No. 2.	To cut hair one-quarter of an inch long	3 50
No. 3.	To cut hair five-sixteenths of an inch long	4 00

## Prices for Sharpening and Repairing.

We are not responsible if teeth break in sharpening.

Sharpening Clippers (our own make)	\$0 50
Sharpening Clippers (not our make)	75
New Top-Plate, including Sharpening	1 00
No. 0 Bottom-Plate, including Sharpening	1 50
No. 1 Bottom-Plate, including Sharpening	1 50
No. 2 Bottom-Plate, including Sharpening	1 75
No. 3 Bottom-Plate, including Sharpening	2 00

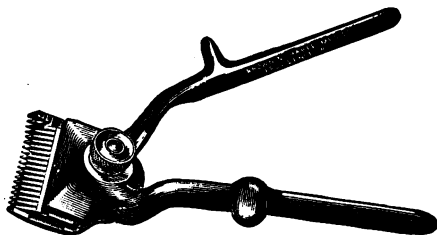
If other parts are needed they are charged extra. Our plates cannot be applied to other Clippers.

We have special facilities for sharpening Power Clippers.

Price for Sharpening Power Clippers	\$1 25
-------------------------------------	--------



## Improved Hair Clippers.



No. 000.	To cut hair very short, about equal to shaving.....	Price, \$3 00
No. 00.	This clipper is the same as No. 0 but narrower.....	" 3 00
No. 0.	To cut hair about one thirty-second of an inch long.....	" 3 00
No. 1.	To cut hair one-eighth of an inch long.....	" 3 00
No. 2.	To cut hair one-quarter of an inch long.....	" 3 50
No. 3.	To cut hair five-sixteenths of an inch long.....	" 4 00

Nos. 000 and 00 are made in this style only, but are narrower.

No. 000 has wing nut.

Sent by mail on receipt of price and twenty-five cents for postage.

## 1893 Design Hair Clippers.



**"BRESSANT"—Trade Mark.**

Registered in United States, France, Germany, Japan, Argentina.

No. 0.	To cut hair one thirty-second of an inch long.....	Price, \$3 00
No. 1.	To cut hair one-eighth of an inch long.....	" 3 00
No. 2.	To cut hair one-quarter of an inch long.....	" 3 50
No. 3.	To cut hair five-sixteenths of an inch long.....	" 4 00

Sent by mail on receipt of price and twenty-five cents for postage.

### PRICES FOR SHARPENING AND REPAIRING.

Sharpening Clippers, our own make.....	\$0 50
New Top Plate, including sharpening.....	1 00
Nos. 000 and 00 Bottom Plate, including Sharpening.....	1 50
No. 0 Bottom Plate, including Sharpening.....	1 50
No. 1 Bottom Plate, including Sharpening.....	1 50
No. 2 Bottom Plate, including Sharpening.....	1 75
No. 3 Bottom Plate, including Sharpening.....	2 00
Sharpening Clippers, not our own make.....	75

**Our Hair Clipper Plates Cannot be Applied to Other Clippers.**

If other parts are needed they are charged extra. We cannot be responsible if the teeth break in sharpening. If Clippers are to be returned by mail, twenty-five cents should be remitted for postage.

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**NEW YORK OFFICE:** 20 Vesey Street, Rooms 900-902.

**PHILADELPHIA OFFICE:** 652-654 The Bourse.

**ROCHESTER OFFICE:** 305 Chamber of Commerce Building.

**SYRACUSE OFFICE:** 419 University Block.

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**COLCORD-WRIGHT MACHINERY AND SUPPLY CO.**

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**KINSEY, E. A. CO.**

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